

COAL AGE

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Our Time-Honored Industrial Democracy

BY R. DAWSON HALL



TIME was when consultation of the men with the management on the conduct of a plant would not have been considered any unusual practice, certainly not one to be dignified as Industrial Democracy. Every workman discussed matters with the boss, and the man in charge did not feel it his duty to say how every item of work was to be done. He left quite a little of the management of materials, time and labor in the hands of the workman and then confidently expected results.

Because we have drawn away from our old habits, when the employee sat down with the boss and talked over affairs and tackled every problem with a sense of teamwork, we have now got to organize what before was instinctive and for this reason we give it a name "Industrial Democracy." When we have to conjure up something with a name, a plan and a blueprint, it is an indistinct ghost of the real thing when it appears.

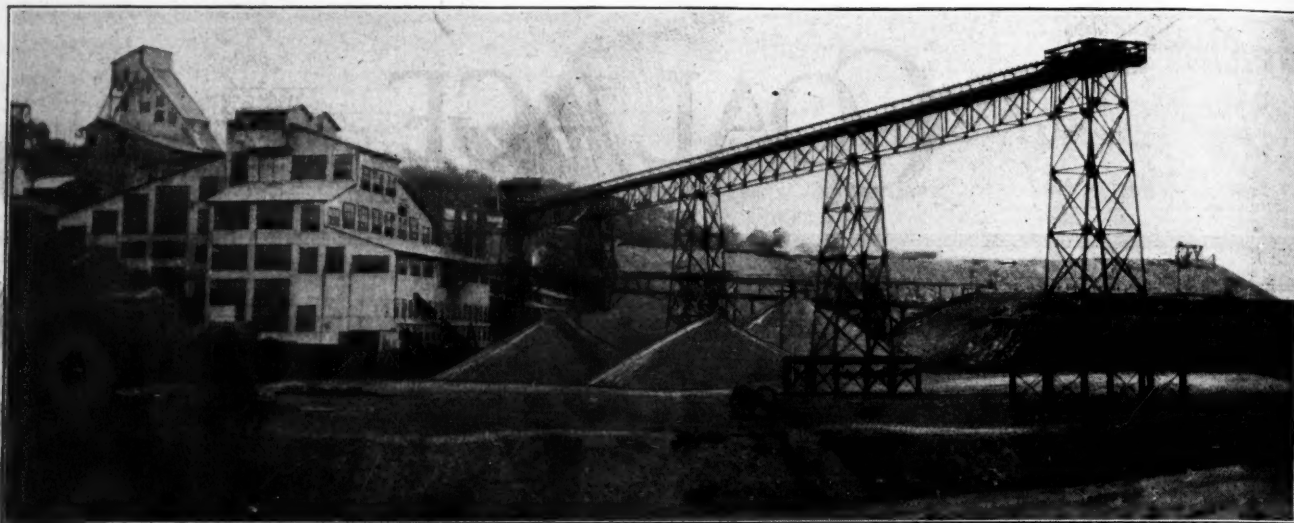
The old industrial democracy which rested on a complete mutual understanding was something far better than the formal schemes that have supplanted it. In those days the workman called round in the evening to talk matters over and he found the boss perhaps surrounded by his family and perhaps toiling in his office but wherever he was, he could be relied on to talk the matter over, ready to take advice and prepared to give a reason.

And to-day it need not be different where men are English-speaking. The big man perhaps may be hard

to reach by all his hundreds of employees, but each of the subordinates at least, should be willing to listen to suggestions, to recognize them when meritorious and give credit for them when adopted. There has arisen an idea that orders, orders, orders shall be transmitted from the man above to the man below. Every detail must be regulated by authority.

The workman knowing his greater knowledge of some details, whether by reason of great experience in that specified work or because of a certain understanding of the local conditions resents orders that only muddle and do not advance the work, given solely in many cases because the man must justify his tenure of office rather than because the orders facilitate the work.

A willingness to cooperate will do as much in most cases as elaborate machinery for conferences participated in by men, who are usually, whether employers or employed, better workers than talkers. The welfare creed, as preached by most expositors, makes an extremely dull sermon. If however, we could restore the old personal touch, if we could infuse with simplicity our whole system of little boss, big boss, bigger boss, and biggest boss, the problem would be well solved. It can be done. Personality can go all the way down the line, however resistant some individuals may be to its impress. Friendliness is said by some to be undignified and undermining of discipline but, persisted in, it will do much to bring back the natural, unaffected, industrial democracy of early days—and you don't need logarithms and the binomial theory, a chart or a blue-print to put it into operation.



Welfare Work at an Anthracite Colliery

A Man's Efficiency Is Affected by His Surroundings—Anything That Fosters Contentment Among Employees Aids the Coal Company—Much Work Has Therefore Been Done Along Welfare Lines

BY DEVER C. ASHMEAD
Tarrytown, N. Y.

UNFORTUNATELY the coal mining company that has adopted the welfare measures here depicted is too modest and retiring to permit me to use its name. It is possible, however, that some readers may recognize the plant in question from the description given and the photographs presented.

This company has been studying welfare work and putting into operation the results of this study for more than 18 years. It has not gone into this for the pure sake of welfare, the primary purpose of its existence being of course to mine coal. The fact that a coal mine is naturally in an isolated community, however, of necessity means that something must be done for the employees in order that the best results may be obtained both for the men themselves and for the company.

GOOD WORKING CONDITIONS MAKE GOOD WORKMEN

Anything within reason that improves the working and the living conditions of the men is to the advantage of the company. Good working conditions make the men better satisfied while at work, and therefore afford them less opportunity to grumble, while better living conditions have a tendency to keep the men at home during the evenings. This means that there is less chance for the talking over of imaginary complaints which are naturally magnified in discussion.

Too much work without a proper amount of enjoyment is also bad for the men and their families. Some play properly organized makes much better workmen and gives them something to think of and to discuss other than themselves or their work. This recreation is not only necessary for the men but also for their wives and other women folks. Dissatisfied home life has a bad reaction upon any human being and therefore interferes with his work.

Not only do the grownups need recreation, good living and working conditions but the future miner and his

wife (the children of the present miners) need these much more than do their parents. Furthermore they need the education to raise them to a higher plane of living and to so train their minds that they can understand economic conditions. Thus their relations with this company or some other when they will go to work will be on a higher plane than that of their fathers.

The first point to consider is therefore how this company provides for the children. From the child the man is made and as the child is so the man is apt to be.

Through the school the child can be reached much better than through the home and through the child the home and its conditions can be improved. The better method is to have the best in the school that can be procured.

The company does not contribute anything in cash to the maintenance of the school, its upkeep or its operation, but it does contribute a large amount in services and advice. Through a personal arrangement with the township board of education the president of the coal company selects the teachers and the very best teachers that can be secured at the stipulated salary are obtained. The township in which this colliery is located is probably the most liberal in the state in the matter of salaries.

As the teachers are so will be the children, for by their example the children are influenced. The teachers are much more important than the environment. Much more is expected from these teachers than from the ordinary pedagogue and they are as a rule much more efficient. The one main attribute that the president of the coal company particularly insists on is a high moral view point. Not only must they have a high moral view point but they must be efficient, know their subjects thoroughly, be able to enforce discipline and still be pleasant. In other words they must be as near perfect as possible and from my talks with them and after see-

ing their work I believe that they fit the conditions almost perfectly.

Next to the teachers comes the environment. It is possible with the aid of a good teacher for a child to acquire an education in dirty unattractive school rooms, but with an attractive environment and a good teacher also much better results can be obtained. The first step in providing the proper setting for a school is the location, next the attractiveness of the building and lastly the interior arrangements. These latter are probably the most important of all.

The school at this colliery is built on a side hill. On the up-hill side the second floor comes to about the level of the street. That is the reason only two stories can be seen whereas there are actually three stories. In the basement (which is really no basement at all but so called because the main entrance is on the second floor) there are four rooms. One room is the class room for the third and fourth grades, another is the study hall for the fifth, sixth, seventh, and eighth grades and the other two are recitation rooms for the pupils of these grades.

On the main floor of the building there are only two rooms, one the kindergarten and the other the first and second grades. The latest up-to-date methods are employed in the kindergarten and the two teachers in charge are graduates of an excellent Chicago school for this type of instruction. There are 38 pupils in this class between 4 and 6 years old and they have the very best of equipment. In the first and second grade room the same system is used as in the kindergarten and in the afternoon a connecting class is conducted for the older pupils in the kindergarten to prepare them for their promotion to the first grade. The kindergarten is used to spread interest among the parents and get them interested in the school and the children.

Much that is somewhat out of the ordinary is done for the pupils of this school. Emphasis is laid upon the

standard subjects and much more attention is given to fundamentals than to such subjects as drawing, music and elocution, although these are taught according to the state law.

Modern methods are exclusively employed at this school. Thus geography is taught by lantern slides. The two higher grades, the seventh and eighth, use the *Literary Digest* for the study of current events. Every week some of the officers of the coal company give talks to the pupils in the higher grades and pay particular attention to economic subjects. A small but well selected library is furnished for the use of the pupils, and their

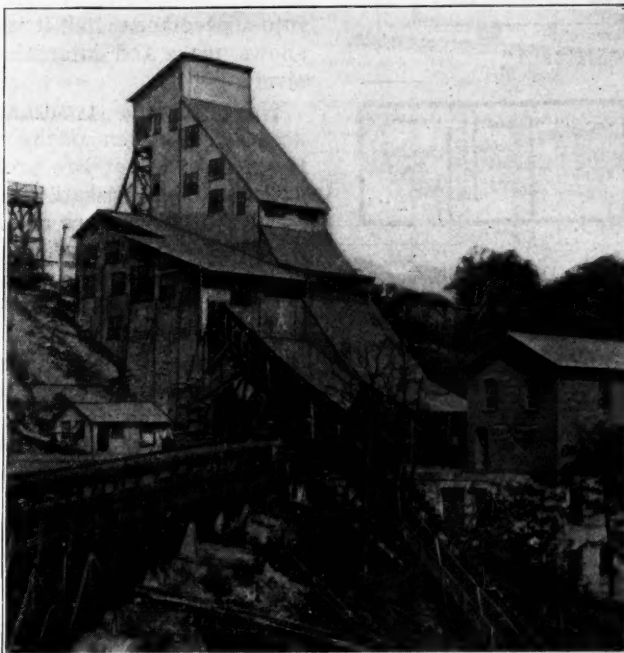
reading is directed as much as possible by the teacher.

The pupils are taught, by daily practice punctuality, regularity, discipline, and thoroughness. Good records are emphasized. Prizes are given for attendance and for high standing and the great desire to secure these prizes and to get their names on the honor roll aids in securing the high standard desired.

Besides the school studies, pleasure and recreation is furnished the children. Every evening the kindergarten room is open and two teachers are in attendance who start the children playing games and see that they are conducted properly. Besides this playtime for the children there are two sewing classes for

the girls, a boys' club, a girls' gymnasium class, a girls' glee club, a once-a-week story hour and a nature study class. In the spring, summer and fall the open air playground which is well equipped is open to the children. The school is now arranging to open a woodworking department in the basement in order to give the older boys manual training.

There are 130 pupils in this school in charge of seven teachers. The average pupil has a higher average standing than the average attained in other schools in the same district. And since this is one of the best districts in the state it follows that the average of the pupils is quite high.

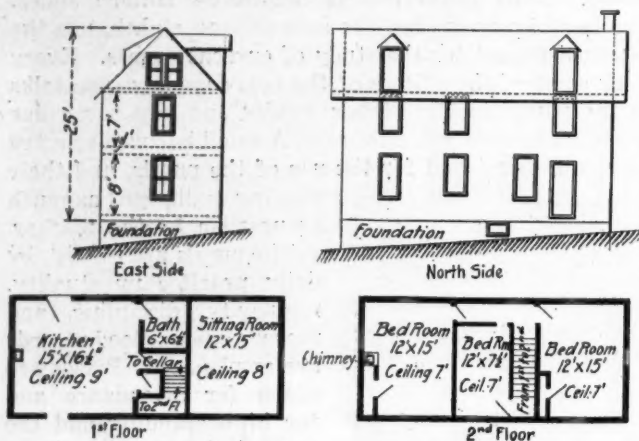


MODERN EQUIPMENT USED AT THE PLANT



ONE HUNDRED AND THIRTY PUPILS IN THIS SCHOOL ARE IN CHARGE OF SEVEN TEACHERS

Probably the feature of community life second in importance to the school is the community club. This is open to all adults for it deals with the mothers particularly, but is commencing to get the fathers interested. The meetings of this club are held on the top



A WELL-DESIGNED ONE-FAMILY HOUSE

floor of the school house in a room attractively decorated and furnished with large wicker chairs, two large library tables, a piano, a circulating library of about 400 volumes and copies of the current magazines. This community club has 80 members at the present time and is growing rapidly. Meetings are held every two weeks and if those present have the "feed" on every occasion that I heard ordered over the 'phone for the meeting held the twentieth of January (6 gal. ice cream, 5 turkeys, etc.) I should think the whole town would join.

As every one will agree a healthy community is usually an industrious one. Proceeding on this assumption the company has engaged a trained nurse to safeguard general health. Every afternoon at 3:30 the nurse and doctor are at the hospital at the top of the manway and conduct a dispensary for minor injuries that the miners may have received during the day. Small cuts are cleaned and treated and as a result there is comparatively little trouble arising from infection at this plant, therefore little time is lost on account of minor injuries. Every pupil at the school is carefully examined once a year. During the day the nurse visits the homes of the miners, tends to all cases of sickness and gives instructions to the mothers concerning the care of their children and the general health of the community.

There is a well equipped dispensary and dental office in one end of the school building where the nurse gives attention to the needs of the school children and to the women of the community. The nurse's living quarters are in connection with the dispensary, so she can be reached at any time in case of emergency. The men are taken care of at the mine hospital at the top of the man shaft as described in the previous paragraph.

The company has built an excellent wash house, as may be seen in the photo. This is constructed of brick and is four stories high. The first two are used for a wash house and the upper two for other purposes. The showers are arranged along the long side of the room and lockers are provided for the use of the men. There are in all 15 showers and lockers provided for 362 persons. This wash house permits the men to go home clean and therefore relieves the women of much unnecessary work.

An excellent club house has been provided for the men and although the building is old it still serves its purpose. The company, however, is not satisfied with it and will start construction in the spring on a new club house and the old one will be turned into an amusement hall. Membership in the club is open to all the men and boys in the community. The new club house is to be large but not elaborate. There will be a spacious lounging room and dancing floor 40 x 70 ft., a kitchen, library, and reading room on the first floor; on the second floor there will be a 40 x 100 ft. basketball court. In the basement there will be the pool tables, bowling alleys, shower baths, etc. When the old club house is turned into a permanent hall it will be used for moving picture shows, plays and entertainments of various kinds exclusively.

Next to the treatment and working conditions accorded the men at the mines the store that supplies the necessities of life probably affects their feeling of satisfaction or dissatisfaction more than any other one element. If expenses are high it means wages are low. A certain rate of wage may be satisfactory or not depending on the cost of living. This coal company has adopted the principle that it is mining coal, not operating retail stores, and that its profits should come from the sale of coal, not from the sale of merchandise. The store is only an accommodation for the men, not a thing of profit for the company.

As a result of this decision and realizing the effect on the miner of unnecessarily high prices the coal company



AN EXCELLENT WASH HOUSE HAS BEEN BUILT

organized the store on a co-operative basis. The prices charged are so fixed that they conform as nearly as possible to the average for that section of the country. At the end of every six months the profits are calculated and a dividend declared which is paid to the miners according to the size of their purchases for the preceding half year. If a miner leaves before the six months period is up he forfeits his right to a dividend on the profits and his share is put in the general fund for

division among the balance of the miners. A newcomer to the community is treated the same as a customer who has been there the full period and receives the same percentage on his purchases. This system encourages the men to stay at the mines so that they will not lose their dividends. This store has 1,200 accounts at a mine employing 500 men.

The store itself is well equipped and is divided into separate and distinct departments, such as shoes, dry goods, groceries, hardware, furniture, and butcher shop. The butcher shop is exceedingly sanitary in its equipment. The ice box is fitted with a refrigerating machine. Large and well equipped storerooms permit the purchase of stock in large quantities, thus allowing the store to take advantage of special prices. The store employs seven persons to attend to the wants of customers and operates two delivery wagons.

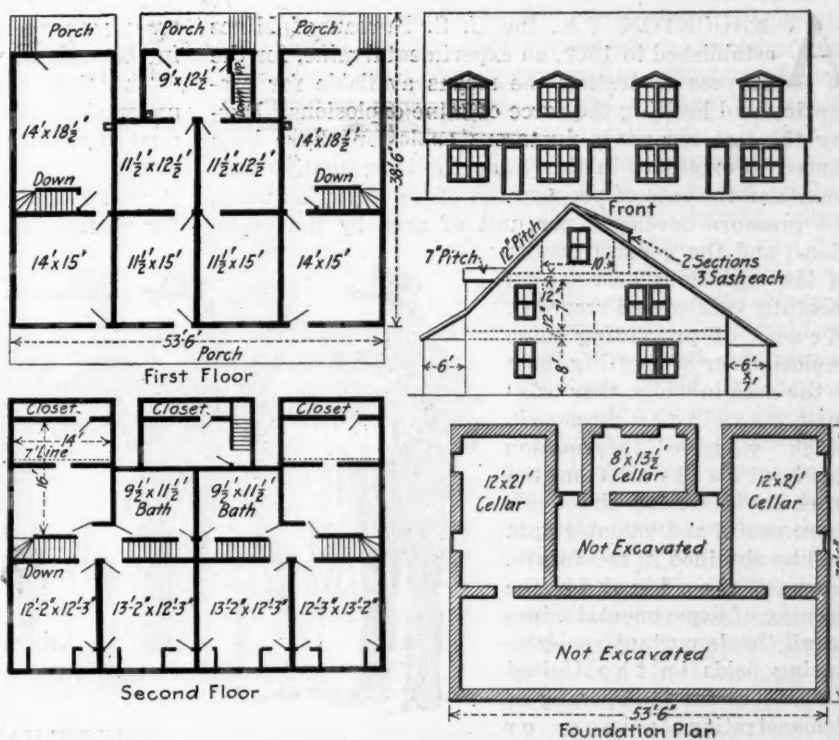
In this community as in most others throughout the country there are a number of under-nourished children, and since the children make the future race, everything possible should be done to better their health. As it is extremely difficult because of the character of the country to have a dairy, the company is making arrangements to install a milk making machine. This takes milk powder, and adds water and butterfat and produces a good milk, enough of which will be made to let every child have all that he or she needs.

As a number of the miners own homes in other districts they have to travel back and forth on the trolley line. The miners' wives also sometimes desire to go to town and it is necessary for them also to use the trolley. This is over a mile from the camp, so the company has established automobile service between the camp and the car line.

As has been above explained, excellent working conditions are provided for the men, satisfactory store arrangements are made, entertainment is provided, their children are furnished with an excellent grammar school education, their health and that of their families taken care of, but this all means little if home conditions are not good. The men are in the mines only eight hours a day, but they are in or in touch with their homes sixteen hours a day. A dirty, nasty home either outside or inside does not make satisfactory surroundings.

Unkempt home surroundings not only affect a man's feeling through the eyesight but they make the wife careless, shiftless, grouchy, the children cross and ugly and the husband disgusted with everything. The company has realized this and is building new and attractive houses. These are of two types, one, a one-family house and the other built for either one, two or three families, depending on the size of the family or families. This latter house is rather unique in its interior design. If this building is to be used for a three family house it is arranged exactly as shown. The center outside door opens into an apartment of five rooms, while the bath room for this apartment is on the second floor over the kitchen.

The two extreme outside doors open into separate houses having two rooms each on the lower floor, with a stairway to the second floor, and there are four rooms for each of the side houses. The two middle rooms are directly over the apartment on the first story. If the family is too large for one of these apartments the wall between the two front rooms on the lower floor between either end apartment and the center apartment is removed. This makes this into one large room and adds three rooms to the apartment. If the number of rooms is still too small for an exceedingly large family a door is cut in the corresponding wall to that which was removed between the first two named apartments. This throws all the rooms in the entire house together.



MUCH CARE WAS GIVEN THE DESIGN OF THIS THREE FAMILY HOUSE

On p. 384 is shown the plan of the single family house. Ordinarily the third floor is unfinished, but if the family is large enough the company finishes the top floor. In the design of all its houses the company insists on a large kitchen, since the ordinary foreigner makes this his living and dining room. The ordinary parlor is usually shut up for state occasions. The company charges a reasonable rent for all its houses, at the rate of \$1 per room per month.

The company goes on the principle that, give a man something to live up to and he will do it. The miners after they move into these interesting houses take considerable pride in them and soon a better grade of furniture arrives and not only is the house itself more attractive but the furnishings improve also.

Besides doing all that has been described for its employees and their families the company goes a step further in its dealings with the men. It is giving them the best possible working conditions, good air, clean mine roads, rapid hoisting, timber promptly supplied and no delay. The company takes away the excuse for not working. It endeavors to make the men like the mine and their work. Previously the men lost much time. Men do not ordinarily leave the employ of the company, but remain with it for sometime.

Some Advantages In Establishing Demonstration Coal Mines*

Experimental Mines Established in Various Coal Fields Would Do Much to Advance Mining Practice, Many Costly and Intricate Problems Influencing Safety and Production Could be Experimentally Determined by Them

BY J. J. RUTLEDGE†
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AT BRUCETON, PA., the U. S. Bureau of Mines established in 1909, an experimental mine, for the purpose of testing the means available for preventing and limiting the force of mine explosions. During the last ten years numerous explosions have been caused to originate in this mine for investigative purposes and the rate of propagation of the explosion wave, the pressure developed per unit of area by the explosions, and the general results of the explosions have been carefully studied and recorded. Means of preventing mine explosions or of limiting them to the area in which they originate have been developed. Much valuable information has been derived from the work in this mine and much more useful and valuable data will be obtained in the future. I would plead, not for the opening of experimental mines in all the important coal-producing fields in the United States, but for the opening of demonstration mines, or mines in which experiments could be made upon the various details of coal mining.

The U. S. Department of Agriculture has established, in nearly every state, stations that undertake experimental work for the benefit of agricultural interests. In addition, small demonstration plots are set aside, in suitable locations throughout the farming districts, where various crops are grown under scientific direction so that the farmers in the neighborhood can note the results obtained and profit thereby. Something of a similar nature should be done for the coal-mining industry. If experimental or demonstration mines were established, methods of operation adapted to local conditions could be worked out.

SMALL CAPITALIZATION MAKES NEW METHODS IMPOSSIBLE

Owing to competition, small capitalization, or low profits, it may be an utter impossibility for any one company to try a new method of mining. Labor conditions may prevent the trial of a new method of working. It may be impossible or inadvisable to disturb existing working conditions for fear of causing trouble

among the miners through real or fancied changes in the scale of wages.

The first and most important investigation to be undertaken in these demonstration mines would be the trial of various methods of working until a satisfactory plan had been demonstrated for each particular district. It would doubtless be necessary to carry on the work for several years before an acceptable method of work-



IF WE HAVE THIS

ing was evolved. The various details of mining associated with such a method could then be experimented with and the best methods demonstrated.

If a certain method or plan of working had been shown to be the safest and most efficient, public opinion would force coal operators to adopt it and, if they did not do so voluntarily, public opinion would furnish moral support to the operators in overcoming any opposition that the miners or other employees might manifest toward the installation of the new and better procedure.

If a new method was found to be safer and more economical than the one in use, the authority of the state could be invoked to support any operator who desired to adopt it. Few coal-mine operators would dare run counter to public opinion even were they to ignore the financial benefits to be derived from the adoption of the new plan. Compensation insurance companies, through their mine inspectors, would give credit to those operations that adopted the new methods, with the result that their liability insurance would be materially reduced in cost.

It is well known that coal miners flock to new mines and new camps, where the housing and living conditions are as a rule better than in the older camps, and the miner's working conditions underground can be made satisfactory from the inception of mining operations.

*Paper presented before the February meeting of the American Institute of Mining Engineers. Published by permission of the Director, U. S. Bureau of Mines.
†Mining Engineer, U. S. Bureau of Mines.

A new and better method of mining would not compel the miner to walk long distances to his working place, through poorly brushed haulageways or manways—perhaps up and down steeply pitching seams.

The new plant would take him to his working place, either by means of a safety car or a mantrip, or by a short walk through well-brushed roadways or manways, with a minimum amount of exertion. He would then be in condition to perform a good day's work, as he would not be tired by his long journey. The ventilation, also would be such that the employees would be able to do a good day's work. The operator who adopted the new plan would have his choice of the miners and their work would be efficient.

It seems strange that coal operators will expend large sums of money for improved mining machinery and fail to make conditions, both under and above ground, such that the employees will be able to perform efficient labor. It is time that technical skill was employed in the underground workings of coal mines to something like the extent to which it has been employed in planning and equipping the surface plant. The most costly sur-



WHY NOT THIS?

face plant will be useless unless commensurate engineering skill is employed to develop and maintain the underground workings.

MOST COMPANIES ARE OF SMALL CAPITALIZATION

No mine can long operate unless a profit is made. Generally speaking, coal-mining companies are of relatively small capitalization and must have an immediate return on the investment—there can be no long wait for dividends, as there is in some other lines of business. No mining company can afford to abandon old prevailing methods and try out new ones, no matter how promising, for fear that the new methods will prove to be unsuccessful and no dividends will accrue. Again, owing perhaps to close competition, one or more of the mining companies may not be on good terms with the other coal producers in the same field, and hence may hesitate to try out a method of working that may prove to be successful and that eventually will be adopted by the competitor, who will reap the benefits of the new method without having expended either time or money in trying it out.

A demonstration mine, on the other hand, operated under government supervision, supported by government funds—perhaps augmented by financial support from the coal operators of the vicinity—can try out various methods of mining and by experiment find which ones

are best adapted to the field. In this way, each method of working would be given an impartial trial under disinterested engineers and miners, whose only purpose would be to learn what plan of working was best suited to the region; coal-mining men, including miners with a practical working knowledge of improved methods of working as carried out in other fields, could be used as a supervisory consulting board. Each person on the board would have a voice in determining the plan adopted and in putting it into execution.

DEMONSTRATION MINES WOULD BE UNTRAMMELED

Since such a mine would be under government supervision and the sole purpose for its operation would be safety and efficiency, it would probably be free from some of the onerous working conditions frequently incorporated in the wage agreements of some of the coal fields. The actual true working efficiency of man and machine could be ascertained without the result being subject to either doubt or criticism. If results of value were secured, the entire coal-mining industry in the field where the demonstration mine was located

would profit thereby, since the information would be free to all. In like manner, if negative results were obtained the entire coal field would be informed so that commercial producers would not try a plan already proved defective.

Inquiries among coal operators in various fields seem to indicate that they would support such demonstration mines both morally and financially. Indeed, it is believed that were such mines to lack financial support from the government, the various mining companies in their neighborhood, who

would be most interested in the results obtained, could be persuaded to furnish the funds necessary to carry out the desired experimental work, the amount necessary being raised by a voluntary assessment on each firm interested. There would be some revenue from the coal produced in the demonstration mine so that some of the money advanced would be returned to those companies that subscribed to the fund. The coal mined would probably be of such grade and quality that it would bring a good price since it would be produced under careful supervision.

Since coal beds differ in character and the same seam may greatly change its nature within the distance of a mile or so, and, moreover, since the nature of the roof or bottom may, and many times does, change within a very short distance so that a method of operation successfully followed in one mine may not be at all adapted to the conditions found in a mine a mile distant, it is, in many cases, necessary to develop plans of working suitable for each particular district.

Various methods of mining can be tried out to ascertain whether or not they are adapted to the conditions in the field where they are tried. If the work in the demonstration mine proves successful, from both an engineering and a business standpoint, the methods can, and doubtless will, be adopted by the other mines in the field where the demonstration mine is located.

Among some of the experiments that could be tried are the following:

Some satisfactory means for preventing the slacking of mine roof during the summer, by the use of gunite or some other form of protective coating.

By experiment find what method of mining is best suited to the field: If pillar and room, whether double entry, entry and air course, or panel system; best width of rooms and pillars; most economical depth of rooms, most satisfactory width and length of room necks, rooms turned off entries at right or at acute angles, or concentrated workings. If longwall, whether advancing or retreating. If advancing, whether Scotch or 45° system, or face track; by hand mining or by machine. If retreating, angle face or straight face, conveyor or face track.

A suitable method of timbering entries and air courses; details of longwall advancing, determination by experiment of the angle of break for machine and hand mining and distance between the lines of break in both methods, and the amount of subsidence.

Best methods of timbering roadways and airways in any special coal field; control of squeezes; best methods of causing roof to break; suitable means for combating bottom heaving; proper explosives; most satisfactory mining machines; method for reducing the depreciation of mining properties; improved methods of haulage; better ventilation systems; generation and distribution of power, especially electricity; most efficient pumping arrangements; safer shotfiring methods; mechanical loaders; underground dragline systems for loading coal into mine cars.

Military Engineers' Society Is Being Organized

Association of Technical Men With Service In Any Branch of Army, is Approved by Chief of Staff

A NATIONAL association of present and former officers of engineers and civilian engineers who have served in any arm or branch of the U. S. Army—Engineers, Ordnance, Signal Corps, Infantry, Cavalry, Artillery, etc.—to be called the Society of American Military Engineers, is being organized by a committee in Washington appointed by the Chief of Engineers. The society's objects are to promote the science of military engineering and to foster the co-operation of all arms and branches of the service, and of civilian engineers, in that science. The objects and a provisional constitution of the society have been approved by the Chief of Staff.

A board of engineers was appointed Nov. 1, 1919, by the Chief of Engineers, to consider and report on the feasibility of a technical organization of officers and civilian engineers experienced or interested in military engineering. At the same time the Chief of Engineers required a letter-ballot for or against such an organization from all Corps of Engineers—officers and temporary engineer officers then in the service. The vote was overwhelmingly in favor of the proposed society.

The board then resolved itself into a committee on organization. Its members are: Colonels F. V. Abbott, Charles Keller, and G. A. Youngberg; Majors George

B. Pillsbury, George R. Spalding, P. F. Bond, Max C. Tyler, John C. Kingman, and David McCoach, and Captain Douglas L. Weart.

Following a canvass of representative opinions which showed reserve officers and others who had been in the engineering service during the war to be strongly favorable to such an organization, the committee drafted a provisional constitution and created a temporary board of directors from its membership. This constitution is already being submitted for approval or comment to individuals who are known to be interested in the organization and eligible to membership; its more important features follow:

The annually elective officers are to be a president and first and second vice-presidents. The president is to be an officer of the Corps of Engineers on the active list. There is to be a secretary, an editor and a treasurer chosen by an executive committee, the first two from the regular army. A board of directors, to have eighteen members, is to be elected by the three divisions of active membership, as follows: six by the regular army; six by the National Guard and reserve forces, and six from the membership exclusive of the foregoing two groups. There is to be an executive committee consisting of the president, the two vice-presidents and not to exceed three others to be elected annually by the board of directors from its own members. Other standing committees are: Rules and ethics; auditing; finance; membership, nominations and necrology; service relations and military policies.

The annual meeting is to be held in Washington, and its date is fixed with reference to that of the American Society of Civil Engineers in order to make possible attendance of members at both meetings. The dues are fixed not to exceed \$5 per per year, those for the present year being \$4.50.

The Society is to publish bi-monthly a journal to be called "The Military Engineer," which will supplant "Professional Memoirs" heretofore published by the Corps of Engineers.

Further information regarding the society may be secured from Col. G. A. Youngberg, Office, Chief of Engineers, U. S. Army, Washington, D. C.

Monongahela River Great Carrier of Coal

The value of the Monongahela River as a transportation medium for the Pittsburgh district of Pennsylvania is evidenced by figures made public recently by the U. S. Engineers' Office. It was shown that, starting in 1898, when the Government took over the locks and dams in the river, the coal tonnage carried on the Monongahela has increased from a little less than 6,000,000 tons a year to more than 14,000,000 tons in 1919. An average of more than 1,000,000 tons a month are transported on the river and locked through the dams of the stream.

In addition to the coal tonnage carried, during the past year (1919), 3,000,000 tons of building material were carried by boat to points along the river. The coal tonnage record, it is said, would have been 1,000,000 tons greater last year had it not been for the coal strike which sadly interfered with production during the latter part of the year and also because the ice in December held up traffic to a marked degree.

Planning A Mine So As To Secure Maximum Recovery*

BY W. B. RIGGLEMAN† AND EVAN L. GRIFFITHS‡
Clarksburg, W. Va.

RECOVERY of coal is an important problem, and before any coal property is developed it should be surveyed, mapped and the entire property projected, and all haulage entries laid off to the best advantage.

This does not mean that every entry driven in the property is to be projected when the operation is first opened, but it does mean that the general plan of the mine must be worked out and definitely adopted. To project mines so as to insure the greatest possible recovery from property,

there are several considerations that must be carefully weighed. Among these are: The location of mine, haulage, drainage, actual method of working, and others. The first proposition is to locate the opening and next the main entries, face entries and butt entries, provided these passages are to be driven on the faces and butts of

coal. This is customary in the Pittsburgh bed, particularly in the northern section of West Virginia.

Main entries are laid off and the face entries turned from the mains at regular intervals. From the face entries, butt entries are turned at the proper places, depending upon the length of the rooms. It is generally the practice in opening coal mines to prosecute development as soon as the main entries are started since this will allow some coal to be produced. This procedure invariably causes a mine to be worked in an improper manner and almost always gives trouble in the end. I have always found that it is the best policy to leave from 200 to 300 ft. of barrier pillar on each side of the main entries and from 150 to 200 ft. barrier pillars on each side of the face entries. Some may argue that it is unnecessary to leave a 200 to 300 ft. barrier pillar on each side of main entries, but after a mine is fully developed and main entry pillars are being drawn one can readily see where this coal would be highly advantageous to the mine.

LARGE ENTRY PILLARS GIVE GOOD FINISH

It would simply mean driving rooms both ways from the main entries when the entry pillars are being drawn. This would allow the output to be kept up until the entire property was worked out.

Face entries should be turned off the main entries at intervals of 1,200 to 1,800 ft., depending on the area to be worked. Some may contend that the distance should be increased to 2,000 ft., and indeed there are a number of arguments in favor of this system, espe-

cially in a bed that dips $1\frac{1}{2}$ to 3 per cent. Pillars should be started at the top of a butt entry with two to three butt entries to a panel. Rooms should never be driven until the pillars can be removed as soon as the rooms are completed.

This, of course, applies to mines where good mining rights were obtained when the coal was purchased; otherwise there would be no necessity of driving entries to their limit and driving top rooms first.

Assuming that good mining rights have been purchased, I would recommend driving room entries to their limit, then at least the top seven or eight rooms should be started and finished. When these rooms have been driven out pillars should be drawn immediately and stepped off so as to be on an angle of approximately 45 degrees. This also applies to advancing rooms on the entry as they should advance on the same angle. It is good policy to have at least two butt entries and possibly three in a panel and have the work handled in such a way as to allow no rooms to be driven until the drawing of pillars can be started. This can be done if proper attention is exercised. The room centers, of course depend considerably on the amount of cover over the coal, but where the cover is not too heavy 60 ft. centers can be worked.

In order to secure a high percentage of recovery it is necessary to develop the mine upon a carefully planned projection or as nearly so as circumstances will permit. The nature and depth of the coal as well as the quality or tenacity of the roof and floor must be taken into consideration in deciding on the mine layout or projection.

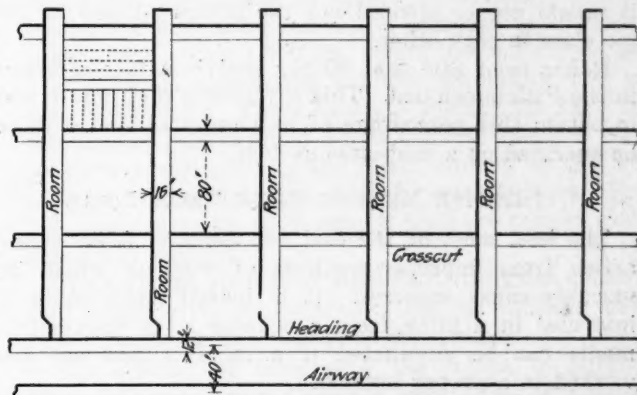


FIG. 1. RELATION OF PILLARS AND ROOMS AND A METHOD OF ROBBING ROOMS

Sixty-foot room centers can be worked to good advantage in the Pittsburgh bed where cover does not exceed 250 or possibly 300 ft. Of course, trouble will be encountered if pillars are not properly stepped while removing the coal.

Where the cover runs from 250 to 500 ft. or even 600 ft., I would recommend that the block system of mining be used. This means that entries would be driven in the usual way, on say 35 or 40 ft. centers.

*Paper presented before the West Virginia Coal Mining Institute, Huntington meeting, December, 1919.

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and rooms turned off every 90 ft. Cross cuts should be driven between rooms so as to make a block of coal 80 ft. square. The rooms are driven in the usual manner and when their limit is reached the pillars are removed.

It is customary to remove the pillars from two different points, one place being driven through the pillar from the room and one driven through the pillar from the cross cut. It is customary in working the block system of mining in the Fairmont field to drive rooms on 96 ft. centers with rooms 18 ft. wide and cross cuts 13 ft. wide.

When a system of this kind is followed there is little likelihood of a squeeze since the large blocks of coal will practically prohibit it. In fact if pillars are properly lined and not too many rooms opened in advance of the pillar work, there is absolutely no chance of a squeeze taking place.

The above system has been tried out extensively in the Fairmont field during the past five years and in a large number of mines it is being worked satisfactorily, especially in mines where the cover over the coal is extra heavy. It would be practically impossible to mine the coal and obtain a good recovery in some operations if the block system of mining had not been adopted. This is because of the fact that otherwise there would be considerable coal lost on account of squeezes.

The block system of mining affords considerable machine coal, as practically all the output can be undercut with machines, except small stumps that are removed by pick work. I do not mean to say that we could not mine coal in a number of mines in the Fairmont field without the block system, but it has been found that better results are obtained with this system in the deeper mines.

Of course no system will afford a good recovery unless it is given careful attention and worked properly. What is meant by careful attention is seeing that entries and rooms are driven on points and that these openings together with cross cuts are driven the proper width. Furthermore, when pillar work has been started it should not be stopped nor the pillars allowed to get too close to each other.

It has been said that 90 per cent is a fair recovery in the Pittsburgh bed. This is indeed a high figure and to obtain this percentage of coal requires that a mine be operated on a first-class system.

IMPROPER METHODS CAUSE GREAT LOSS

The loss, most of the coal not removed from mines, arises from improper methods of working which invariably cause squeezes. It is indeed unfortunate to lose coal in a mine from a squeeze since such settlements can be eliminated if a mine is laid out and worked in a proper manner.

We are convinced that in order to obtain the greatest percentage of recovery from any property it is necessary to lay out the mine as suggested above, deciding on the thickness of barrier pillars, and working according to projections. A large number of mines are cut up badly because projections were continually changed.

The best idea is to decide on a definite plan and see that the projections are followed unless something unforeseen develops which, of course, would necessitate making changes. Many projections are changed unnecessarily.

In some sections pillars cannot be removed on account

of roof conditions. This of course could not be taken into consideration in recovery of coal, as high recovery can hardly be expected where the full bed cannot be removed.

LEAVING BLOCKS OF COAL AROUND OIL OR GAS WELLS MAKES RECOVERY DIFFICULT

There are again a large number of mines where coal is worked and according to leases (or deeds) conveying the coal the surface cannot be broken. This indeed is unfortunate, but in some cases pillars are required to be left for protection of surface upon which houses or other buildings have been constructed. There is also considerable coal left around oil and gas wells, especially in the Fairmont field. This aggregates a large amount but is necessary in order to properly protect the mines. The leaving of blocks of coal around various oil and gas wells is dangerous, since a block of coal as much as 200 ft. square may be required in a section of pillars. When pillars are approaching a block of coal of this kind it always gives considerable trouble and interferes with recovery.

The roof and bottom conditions in coal mines vary considerably and this always has much bearing on the size of pillars to be left. The smaller beds which are worked more extensively in the southern part of the state have a good roof, one in fact that is much better than the roof over the Pittsburgh bed of coal in the Fairmont field. The recovery per acre in the thinner seams such as the Sewell, Welch, Fire Creek, Pocahontas, etc.,

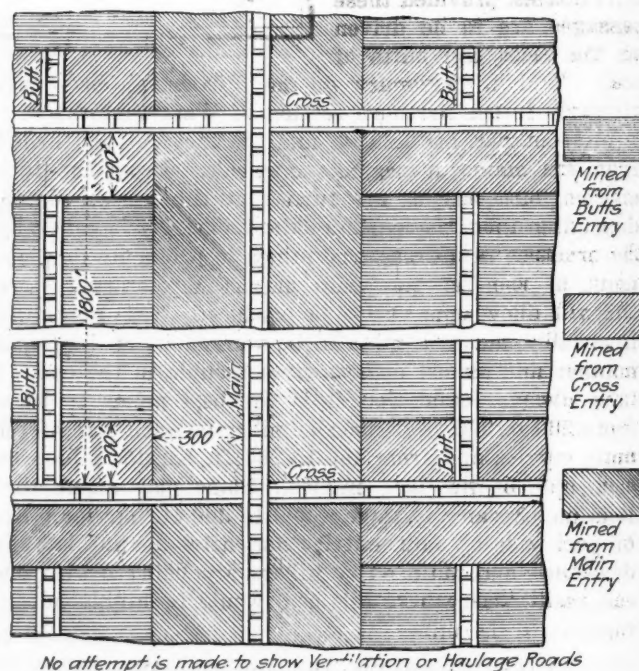


FIG. 2. SHOWING THE AMOUNT OF COAL TO BE REMOVED BY VARIOUS METHODS

should be excellent, provided the mines are laid off on a proper plan. It is almost always found, however, that the pillar work in a low seam is allowed to get behind and pillars are not drawn at the proper time.

To recover a good percentage of coal in any bed requires that a mine be laid off on a good plan and that sufficient pillars be left so that pillar sections can be started where desired.

It has been noted in a large number of operations that entries and rooms have been driven after a plan

that calls for the removal of pillars some time in the future. This may be satisfactory but will never allow a good recovery of coal, especially where the proper size of barrier pillars have been left. Pillar strength should be figured to carry its own burden plus the weight that will be added as the adjacent pillars are removed in their regular turn.

The size of pillars must naturally depend upon the nature of the material, since soft coals are more liable to chip or split off, weakening the pillar. When the bottom and roof are of different character, the pressure on the pillars will show by their being forced into the softer of the two materials.

PRESSURE AND STRESS INCREASE WITH BED DEPTH

In laying off a mine preparatory to development it is well to remember that the pressure, as well as the stress on the pillars, increases with the depth of the bed below the surface. The basis for estimating the size of pillars that may be safe with 500 ft. cover will not apply where the cover is 1,000 ft., neither does the same ratio hold good at 1,500 feet.

No mention has been made concerning timbering in connection with recovery of coal, but it is understood that timbering is a separate consideration, since practically all mines require a different rule for supporting the roof in working places. It is advantageous to determine a plan for timbering in each mine and follow this out with no change whatever. This means that timber will be set in all working places in accordance with a regular system, regardless of whether or not it is actually necessary, and that the same method of timbering will be carried out all over a mine. In some places timbering will be done where it is not necessary, but this will, of course, give assurance that adequate timbering will be done where needed.

In conclusion it should be stated that in order to recover a fair percentage of the coal from any property the mine should be laid out on a good plan, leaving sufficient barrier pillars and driving rooms in sections so that the pillars can be removed immediately after the rooms are finished. In no case can a good recovery percentage be realized unless some such plan is followed.

Plant at Lynch, Ky., Is Rapidly Nearing Completion

THESE are busy days at Lynch, Ky.—the scene of the latest of the United States Coal & Coke Co.'s operations. Construction on the plant buildings and the town itself is going forward at a pace that suggests the thought that some active dynamic force is overseeing each individual operation. Activity is manifest everywhere. In fact, the scene with its army of workers recalls similar ones in France in the spring and summer of 1918 when army base hospitals and concentration camps were springing up over night. Locomotives are busy switching to and fro; in the quarries on the hillsides, the sound of exploding dynamite is heard; steamshovels take a fitting place in the general arrangement, while no less workmanlike is the sound of the riveter's hammer and the buzz of the saw.

The latter part of 1917 witnessed the initial step in the transformation of this Kentucky wilderness. Some day in the early future Pullman porters will announce Lynch as one of the few stops on the direct line to Louisville or Cincinnati, for Lynch is destined to become a

city just as surely as "hoe-cake" is found on the menu cards as soon as the Mason & Dixon line is left to the northward.

Eleven drift entrances are already well advanced. These are located on either hillside with the town lying in the valley. Already 7,000 tons of coal passes over the tippie daily. All of the development work is at present confined to one bed. This is the "C" of the Pottsville Conglomerate Series, known in other localities as the Roda or Elkhorn. Nearly 45,000 acres of coal will eventually be developed of which it is planned to load the tonnage from 20,000 acres over one tippie at the rate of 10,000 tons daily. And even this remarkable figure will be by no means hard to attain, for the tippie has been designed to accommodate a daily output of 18,000 tons if necessary. This is truly a marvelous capacity when a comparison is made with the 3,000- and 4,000-ton capacity plants of the present or even with some of the larger Illinois mines where large tonnage is accepted as a matter of course.

Each year the coal industry points with particular pride to some individual mine with a large output and immediately the conclusion is reached that here is the limit. Yet who shall say that Lynch is to be the last word in highly concentrated mining methods when rotary dumps and the skip method of hoisting are still in their infancy, to say nothing of the possibilities of belt conveying from the working face?

From present indications it will be next fall before the plant buildings will have all been completed. One has to be in Lynch today to appreciate the vast amount of work that has been done in a relatively short space of time. The tippie, a square building of reinforced concrete and native stone construction, is equipped throughout with electrically operated shaker screens, picking tables and loading booms. However, most of the coal that will be loaded will be mine-run, for it eventually is to be coked in the byproduct ovens of the United States Steel Corporation.

The power house is of the same type of construction as the tippie and contains three Stirling boilers with an aggregate horsepower of 2,200. The steam is superheated 100 deg. and carried at a pressure of 200 lb. per square inch. Two 1,500 kw. steam turbine driven General Electric, alternating current generators will produce 6,600 volts. Three concrete substations have been constructed underground where General Electric rotary converters will produce the direct current at 250 volts after it has been stepped down by transformers. From the power plant the high-tension lines are carried underground by conduit.

The machine shop is of steel and wire glass construction which gives an admirable natural lighting effect. It will be electrically equipped throughout.

The scheme of developing the mines is purely a United States Coal & Coke Co. idea. This is a subject in itself and will not be taken up until such a time as the surface buildings have been completed and *Coal Age* is able to offer to its readers a more detailed description of the operation at Lynch. Half of the pillars are robbed advancing and the remainder in retreat. The haulage roads are solidly built and in such a manner as to guarantee a maximum of use. All room entries are double tracked and locomotives place the cars at the room necks. Much needless switching is thus avoided and considerable time saved. The thickness of the bed is expected to average 5½ ft. throughout the tract.

Low-Temperature Carbonization of Coal*

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THE low-temperature carbonization of coal involves the carrying out of the coking process under conditions wherein neither the coal mass nor any of the passageways through which the volatile products pass are heated above 700° or 800° C. (1,252° to 1,472° F.). For convenience in this discussion, the single number 750° C. (1,382° F.) will be used to designate the maximum range. This temperature is not selected arbitrarily; it is the result of certain natural conditions that are inherent in the substances involved. Two of these conditions are sufficiently pronounced to suggest a line of demarcation at this point, and are as follows: (1) Below 750° C. all the heavy hydrocarbons are expelled, which means that, at lower temperatures, the illuminants, the gases of high calorific value, and the condensible oils are discharged; above 750° C. there are given off the lean, non-illuminating gases consisting for the most part of hydrogen and marsh gas and having no condensible constituents. (2) Below 750°, there is substantially no secondary decomposition; above

temperatures the step is a moderate one, as, for example, from xylene to toluene or from toluene to anthracene. These changes are moderate in amount. Not only do the reactions proceed slowly but the gases are subjected to the decomposing conditions for only a short

TABLE III. TEMPERATURE READINGS AT CENTER OF MASS

No.	Sample	End of First Hour, Degrees C.	End of Second Hour, Degrees C.	End of Third Hour, Degrees C.	End of Fourth Hour, Degrees C.	Total Time of Carbonization
125	Herrin, Williamson Co., Ill.	300	420	590	760	4 hr. 30 min.
128	Harrisburg, Saline Co., Ill.	300	430	660	790	4 hr. 15 min.
129	Harrisburg, Saline Co., Ill.	275	390	590	770	4 hr. 30 min.
140	Georgetown, Vermilion Co., Ill.	330	375	580	800	3 hr. 45 min.
130	Fairmont, W. Va., Pittsburgh Seam, high volatile.	330	430	590	750	4 hr. 45 min.
131	Fairmont, W. Va., Pittsburgh Seam, high volatile.	290	390	610	750	4 hr. 45 min.
132	Fairmont, W. Va., Pittsburgh Seam, high volatile.	320	395	550	730	5 hr.
135	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile.	320	420	505	610	6 hr.
136	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile.	320	450	570	730	5 hr.

TABLE I. COKE FROM LOW-TEMPERATURE CARBONIZATION

No.	Sample	Moisture, Per Cent.	Ash, Per Cent.	Volatile Matter, Per Cent.	Fixed Carbon, Per Cent.	Sulphur, Per Cent.	Heat Value in B.t.u.
125	Herrin, Williamson Co., Ill.	0.11	13.48	6.01	80.40	1.89	12,627
128	Harrisburg, Saline Co., Ill.	0.55	10.65	6.15	82.65	1.78	13,154
129	Harrisburg, Saline Co., Ill.	0.25	9.50	11.70	78.55	1.94	13,267
140	Georgetown, Vermilion Co., Ill.	0.22	15.59	5.02	79.17	1.47
130	Fairmont, W. Va., Pittsburgh Seam, high volatile.	0.63	11.11	11.64	76.62	1.17	13,624
131	Fairmont, W. Va., Pittsburgh Seam, high volatile.	0.61	10.31	5.52	83.36	1.00	13,916
132	Fairmont, W. Va., Pittsburgh Seam, high volatile.	0.31	10.03	4.12	85.78	0.90	13,851
135	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile.	0.29	6.75	3.83	87.69	0.77	14,430
136	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile.	0.18	8.00	4.15	87.67	0.75	14,281

750°, the volatile products are readily decomposed, forming tars, naphthalene, free carbon, etc.

It is not intended to maintain that no secondary decompositions occur below 750° C. Many recent studies have demonstrated the practicability, especially in the presence of catalytic substances, of cracking certain of the hydrocarbon compounds; but at these lower tem-

time. This is evident when it is recalled that at these initial temperatures the decomposition of the coal is rapid and, if anywhere near a neutral pressure is maintained, the movement of the evolved gases is lively and reduces, correspondingly, the time of their retention in the passageways where these milder decomposing conditions exist.

It is acknowledged that the maintenance of these temperature conditions at the present time has only an ideal and not a practical status. Actual operations under these conditions, as an industrial accomplishment, is still in the experimental stage. However, many tendencies and many experimenters, not to say promoters, are working toward this goal and the topic is certain to be

TABLE II. ANALYSIS OF COAL

No.	Sample	Moisture, Per Cent.	Proximate Volatile Matter, Per Cent.	Fixed Carbon, Per Cent.	Ash, Per Cent.	Sulphur, Per Cent.	Hydrogen, Per Cent.	Ultimate Carbon, Per Cent.	Nitrogen, Per Cent.	Oxygen, Per Cent.	Heat Value in B.t.u.
125	Herrin, Williamson Co., Ill.	6.07	33.60	50.23	10.10	2.79	4.74	69.26	1.47	5.78	12,663
128	Harrisburg, Saline Co., Ill.	4.83	35.32	52.87	7.00	2.11	5.01	70.94	1.59	8.52	12,840
129	Harrisburg, Saline Co., Ill.	4.02	35.33	54.31	6.34	2.20	5.1	71.20	1.59	8.55	12,839
140	Georgetown, Vermilion Co., Ill.	15.09	32.76	42.65	9.50	1.61	4.18	59.83	1.26	8.53	10,782
130	Fairmont, W. Va., Pittsburgh Seam, high volatile.	3.38	35.34	54.01	7.27	1.28	4.94	75.84	1.50	5.59	13,624
131	Fairmont, W. Va., Pittsburgh Seam, high volatile.	1.32	35.62	55.78	7.28	1.40	4.73	78.15	1.49	7.03	13,916
132	Fairmont, W. Va., Pittsburgh Seam, high volatile.	3.14	35.30	54.41	7.15	1.0	4.88	77.95	1.51	4.37	13,698
135	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile.	1.84	15.81	75.55	6.80	0.78	4.10	82.24	1.41	3.83	14,243
136	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile.	1.43	16.21	75.61	6.75	0.72	4.21	82.06	1.39	3.44	14,283

*Paper presented before the American Institute of Mining and Metallurgical Engineers, February, 1920, from material in preparation as a bulletin of the University of Illinois Engineering Experiment Station, by permission of the director.

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‡Associate in Chemistry, University of Illinois.

TABLE IV. TYPE OF GASES PRODUCED FROM LOW-TEMPERATURE CARBONIZATION

No.	Coal Sample	CO ₂	O ₂	C ₂ H ₄	C ₂ H ₆	H ₂	CO	CH ₄	C ₃ H ₈	N
125	Herrin, Williamson Co., Ill.	5.0	1.1	1.4	1.1	44.1	6.6	38.2	3.1	2.0
128	Harrisburg, Saline Co., Ill.	4.2	0.7	1.9	1.4	48.1	4.5	33.0	3.1	2.1
129	Harrisburg, Saline Co., Ill.	4.6	0.7	1.6	1.4	47.8	4.7	29.5	4.7	5.0
130	Fairmont, W. Va., high volatile	3.9	0.8	1.5	1.6	47.3	4.3	33.2	4.5	5.0
131	Fairmont, W. Va., high volatile	4.4	0.8	1.7	1.8	44.0	5.1	32.8	5.4	4.0
132	Fairmont, W. Va., high volatile	5.2	0.7	1.3	1.7	37.5	4.8	29.3	6.8	4.5
135	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	1.1	0.6	0.5	0.8	58.5	2.4	29.0	2.8	4.3
136	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	0.6	0.6	0.3	0.7	65.1	0.2	28.4	0.2	3.9

one of great interest until we have come much nearer the ideal in practice. It is not the purpose of this paper to discuss possible methods whereby this end may be attained. Any industrial process has in the main only negative results to report when it is in the development stage; otherwise it would not be in that stage. There is a definite value, however, in setting forth in quanti-

tion was given to methods of manipulation and where quantitative data as to byproducts were meager and occasionally in error.¹

The results in the tables are sufficiently specific and a further discussion must be reserved for a bulletin wherein it is hoped that additional data will be available concerning the composition of certain of the byproducts, especially the tars. Attention may be called to certain items as follows:

(1) The temperature conditions were maintained consistently throughout so that uncertainty on that point is eliminated.

(2) The yield of byproducts from a given type of coal is sufficient in form to afford strong presumption as to the fact that these are the normal values that may reasonably be expected under low-temperature carbonization conditions.

(3) The tars are of unusual interest and require further study to arrive at full information concerning this product. The high content of free carbon in the last two samples of Table 6 is due to dust mechanically carried over and not to secondary decomposition.

(4) The gas yield represents unusually high calorific values. The columns A, B and C, Table 7, represent the

TABLE V. TARS FROM LOW-TEMPERATURE CARBONIZATION OF COALS

No.	Sample of Coal	Yield per Ton, Gallons	Specific Gravity, 15.5° C.	Free Carbon Per Cent.
125	Herrin, Williamson Co., Ill.	19.75	1.065	1.8
128	Harrisburg, Saline Co., Ill.	22.00	1.059	0.5
129	Harrisburg, Saline Co., Ill.	23.56	1.057	0.5
140	Georgetown, Vermilion Co., Ill.	13.85	1.07	0.5
130	Fairmont, W. Va., Pittsburgh Seam, high volatile	28.33	1.061	0.5
131	Fairmont, W. Va., Pittsburgh Seam, high volatile	25.00	1.06	0.5
132	Fairmont, W. Va., Pittsburgh Seam, high volatile	29.25	1.06	0.5
135	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	7.15	1.1	5.5
136	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	7.0	1.1	10.7

tative terms, so far as they may have been determined, the factors that represent the normal yield to be expected if conditions are maintained as planned. An added reason for offering such data is the tendency to make extravagant and unwarranted statements regarding the value and quantities that accompany the low-temperature process.

The apparatus employed in the experiments from which the data here presented was secured is capable of handling from 25 to 35 lb. of coal at a charge. The heat is applied by means of an electric current, the amount of resistance wire being so adjusted as to produce a temperature not over 800° C. The cross section of the retort is 7½ in. Pyrometer readings are taken at the center of the mass and next to the wall of the retort. The coals employed were mainly from Illinois but the experiments were extended to include samples from Indiana, Kentucky, West Virginia, and Pennsylvania. As already noted, it is the purpose of this paper to give as nearly as possible what may be looked upon as a normal value for the different products obtainable from the various coal samples employed. In this particular, therefore, it is supplementary to bulletins already published by the Engineering Experiment Station of the University of Illinois, wherein chief atten-

TABLE VII. GAS FROM LOW-TEMPERATURE CARBONIZATION

No.	Coal Sample	Yield, in Cu. Ft. of Coal	Heat Value in Each Foot, B.t.u.			Sulphur in Each Foot-Grain Per 100 Ft.		
			A	B	C	A	B	C
125	Herrin, Williamson Co., Ill.	3.0	967	685	435	244	44	12
128	Harrisburg, Saline Co., Ill.	3.2	900	628	428	391	200	96
129	Harrisburg, Saline Co., Ill.	3.2	892	676	443	303	206	93
140	Georgetown, Vermilion Co., Ill.	3.4	845	541	465	198	122	28
130	Fairmont, W. Va., Pittsburgh Seam, high volatile	3.4	995	685	462	404	254	34
131	Fairmont, W. Va., Pittsburgh Seam, high volatile	3.3	950	631	430	444	235	34
132	Fairmont, W. Va., Pittsburgh Seam, high volatile	3.3	946	678	450	318	59	52
135	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	3.2	632	421	362	11	2	0
136	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	3.7	745	564	410	19	13	0

first, second, and third cubic foot of gas discharged per pound of coal.

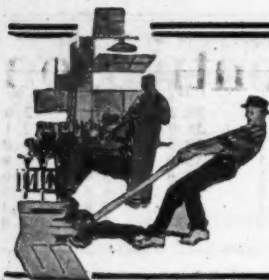
(5) The behavior of the sulphur is, in some respects, the most important of all the data. It will receive more detailed discussion in the larger publication.

(6) The coke is, in many respects, the most interesting product of all and will be discussed more fully in the proposed bulletin.

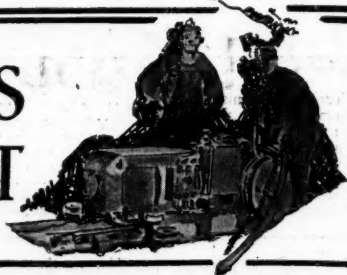
TABLE VI. TYPE OF TARS FROM LOW-TEMPERATURE CARBONIZATION

No.	Coal Sample	Specific Gravity, 15.5° C.	Free Carbon, Per Cent.	Up to 190° C.	Per Cent Distillation 190° to 300°	Distillation 300° to 360°	Pitch	Per Cent Fractions up to 300° D. C.		
								Tar Acids	Amines	Paraffins
125	Herrin, Williamson Co., Ill.	1.065	1.8	2.8	33.8	24.4	38.9	45.0	3.6	8.0
128	Harrisburg, Saline Co., Ill.	1.059	0.5	1.4	41.3	32.8	24.5	45.0	3.0	10.0
129	Harrisburg, Saline Co., Ill.	1.057	0.5	1.5	44.9	33.8	19.8	47.0	4.0	10.0
130	Fairmont, W. Va., high volatile	1.061	0.5	2.0	41.0	31.0	26.0	40.0	4.0	12.5
131	Fairmont, W. Va., high volatile	1.06	0.5	2.0	36.5	31.0	30.5	36.0	4.0	12.4
135	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	1.093	5.5	0.0	29.4	30.9	39.7	20.0	8.0	12.0
136	"Jenner Coal," Somerset Co., Pa., C Prime Seam, low volatile	1.148	10.7	0.0	24.0	33.2	42.8	20.0	6.0	10.0

¹S. W. Parr and H. L. Olin: "The Coking of Coal at Low Temperature," Bull. 60 and Bull. 79 (1913, 1915).



NEW APPARATUS AND EQUIPMENT



An Electric Bond Tester

One of the new pieces of apparatus being manufactured by the Joy Machine Co. of Pittsburgh, Pa., is an electric bond tester. This is of rugged construction and built to withstand the rough usage that such devices receive around coal-mine plants. This tester is self-contained and does not depend upon any return current in the rail for its operation.

Energy is supplied by a dry cell battery which is incased in the handle. The simplicity of construction



LITTLE EXPERIENCE IS NEEDED TO OPERATE THIS MACHINE

which necessitates but a minimum amount of care as well as experience to operate this machine makes it a valuable piece of apparatus around a coal mine. Faulty bonding is an evil that does much toward increasing transportation difficulties.

In using the instrument, it is placed in position as shown in the accompanying illustration. A pair of drill bits used as contact points bear upon each abutting rail. The switch in the handle is then closed and by means of a downward pressure, the drill points rotate and cut through any rust or other extraneous material

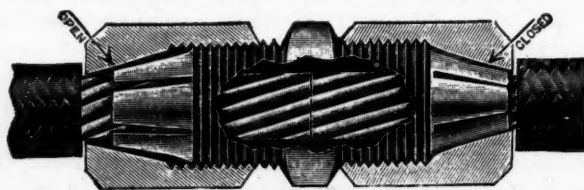
on the surface of the rail until the current is set up through the rail joint.

The lower part of the instrument incases a buzzer which operates if the current is not closed between the two rails. If the bond is defective, a buzzing sound will be heard in the receiver, the intensity of which gages the degree of imperfection of the bond. In the case of a perfect bond, the circuit between the contact points will be closed and the buzzer will not operate.

The only part of this device subject to rapid deterioration is the dry cell inclosed in the handle. It may be necessary to replace this battery every six or eight weeks, depending upon the amount of use given the apparatus. An ordinary flashlight battery is employed. This may be obtained from any merchant handling the proper size. The cell is placed in the battery-case with the zinc end upward so as to bear against the contact spring.

Solderless Connectors

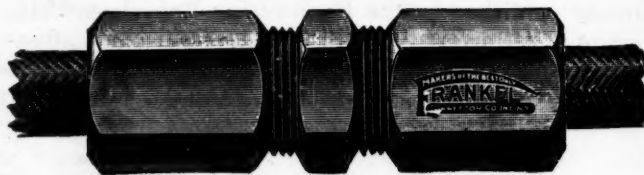
The Westinghouse-Frankel solderless connectors recently placed on the market represent a new method of splicing electrical conductors which combines reliable service with high efficiency and marked economy. These



CROSS-SECTION SHOWING CONSTRUCTION

connectors are simple in design, strong, and easily installed. They are made in various styles and sizes for adaptation to all types of splices with all varieties of wire.

In making use of a two-way connector, the insulation is removed from the ends of the cable or wire, to be spliced for a distance equal to half the length of the connector. The bared ends are then inserted into the connector so that they meet at the center, after which



A COMPLETED SPICE

the compression nuts are tightened. These nuts are so constructed that they force inward a set of jaws at each end of the connector, causing them to grip their respective conductors firmly, forming a perfect joint. Splices with the other styles are made in the same manner as with the two-way type.

Considerations Influencing Mine Ventilation

By R. Z. VIRGIN
Pittsburgh, Pa.

PRESENCE or rather the absence of restrictions or obstacles in mine airways are of vital importance. Such obstructions offer resistance to the air current that it is necessary to keep flowing through the mine workings, in order to insure the health of the workmen and comply with various state laws. This resistance means friction and an increased cost of power expended in ventilation.

The power required to drive the air through the mine is largely consumed in forcing it through the headings, entries and other passages of small or limited cross sectional area. Unfortunately in many mines such restricted passages are used as man- and haulageways as well as airways.

Modern coal mines are projected upon such a plan as to provide multiple entries, generally sufficient in number and cross sectional area to permit the passage of sufficient ventilation independent of the haulageways. Older mines, opened and worked upon the double entry plan, do not as a rule afford the unobstructed passages necessary to efficient ventilation. Consequently as the haulages grow longer the volume of air transmitted becomes less, the expense for ventilation power becomes greater and costs go up.

It is often the case that high ventilation cost is not rightly chargeable against the superintendent's efficiency as a manager. This is however rarely considered when comparative cost sheets are examined. It is frequently necessary therefore for the mine manager to do the

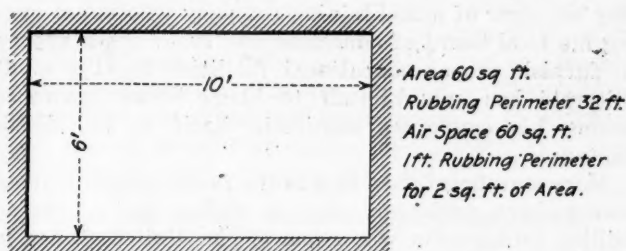


FIG. 1

KEEP ALL PASSAGES CLEAN AND IN GOOD CONDITION

best he can with the means at hand. This can, in a measure, be accomplished first by keeping all airway passages clean and in good condition and second by permitting cars to stand in airways as little as possible.

The significance of the latter suggestion is well shown by reference to the accompanying illustrations. Fig. 1 shows an entry 6 x 10 ft., or one having a cross sectional area of 60 sq.ft. The perimeter or line of rubbing contact is $10 + 10 + 6 + 6 = 32$ ft. Let us assume that a certain quantity of air is passing through this airway and that a water gage of 2 in. is required to force its passage. This is equivalent to a pressure of $2 \times 5.2 = 10.4$ lb. per square foot necessary to propel this air through this passage.

Fig. 2 shows the same size of airway after the introduction of a standing car or trip. This car has dimensions, as shown, of 4 x 5 ft. or an effective "obstruction" area of 20 sq.ft. This, subtracted from the cross sectional area of the entry, leaves $60 - 20 = 40$ sq.ft. of effective area. The peculiar circumstance about

this type of obstruction, and a factor that is seldom given consideration is that while the area for the passage of air has been reduced 33 per cent the actual rubbing surface encountered by the air current, has been increased by the perimeter of the car or 18 ft. making a total perimeter of $32 + 18 = 50$ ft.

Fig. 3 shows a fall of rock in the same airway. For purposes of illustration this fall has been assumed to

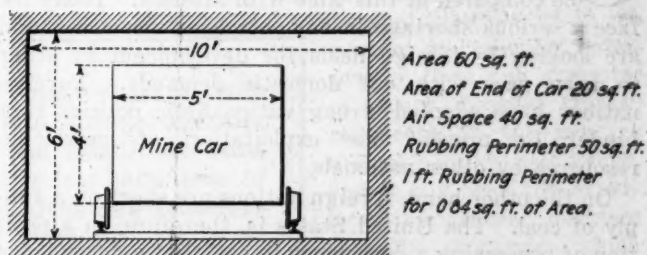


FIG. 2

MINE CAR IN SAME AIRWAY AS SHOWN IN FIG. 1

have the same cross sectional area as the mine car. On account of its nature and location however it does not offer as effective an obstruction to the passage of air, since its rubbing surface is less.

In this figure the available free cross section is 40 sq.ft. as before but the rubbing perimeter is in this case only 45 sq.ft. This clearly shows that a fall of rock with a total cross sectional area equal to that of a car is less detrimental to ventilation power costs than a car. This, of course, assumes that the length of the fall is the same as that of the car or trip as the case may be.

The first law of air friction shows why this is the case. This law states: The pressure required to overcome friction varies directly as the rubbing surface. We have assumed above that the pressure required to force a given quantity of air through the unobstructed airway is equal to 2 in. of water or 10.4 lb. per sq.ft. In the second case, other things being equal, the necessary pressure would be found as follows: 32: 50:: 10.4: X.

or $X = 16.25$ lb. per sq.ft.

In the second case the necessary pressure would be found similarly: 32: 45:: 10.4: X

or $X = 14.62$ lb. per sq.ft.

These increased pressures require increased power

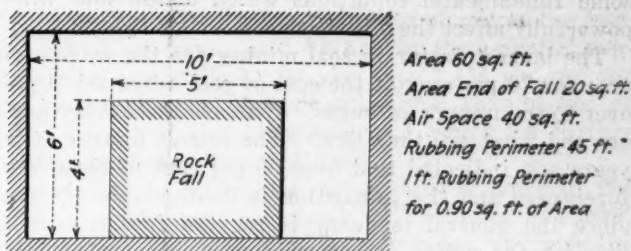


FIG. 3

RUBBING PERIMETER IS LESS THAN IN FIG. 2

and increased power means additional expense. If, on the other hand, increased power is not available the volume of air flowing will be decreased. In either case explanations may be necessary from the management.

Problems of the Coal Industry*

Miner, Operator, Railroad and Consumer Are All Dissatisfied With Existing Conditions in the Coal Industry—The Interests of Each Must Be Safeguarded

BY VAN. H. MANNING†
Washington, D. C.

COAL and petroleum are two great sources of power, and the state of these two industries may be compared at this time with interest. Today we face a serious shortage in our petroleum resources, and are looking to foreign fields for development in order to keep pace with our domestic demands. Foreign nations have adopted strong nationalistic policies that hinder or prevent the exploitation of petroleum resources by other nationals.

On the other hand, foreign nations are short on a supply of coal. The United States is, therefore, in a position of possessing a dominance in coal, but a dependency in oil.

Coal and oil in one form or another are used in every household in the civilized world. Therefore, it is not unreasonable for the consumer to wonder when the price of either goes up. The welfare of any industry must be considered in connection with the welfare of the people. Capital and labor cannot disregard the public.

Therefore, the public must be represented and be given due consideration. The November, 1919, coal strike was a concrete example of what the public has to suffer when the employer and the employees fail to adjust their difficulties and production is brought to a standstill.

MANY PROBLEMS DEMAND SOLUTION

The problems of the coal industry are many, and some of them are exigent. The four parties at interest: the miner who digs the coal, the operators who own the properties and manage the industry, the railroads that transport the coal, and the consuming public which finally pays for the joint product of the other three, are all dissatisfied with conditions as they are at the present day.

Some of the problems, those that are most clearly defined and seem to offer the most promising field for definite action, are being discussed at length, but I want to paint in a background for them by briefly referring to some fundamental conditions which obtain and which powerfully affect the situation as it exists today.

The largest factor in coal mining are the wage-earners; for 70 per cent of the cost of coal as mined is paid over to the miners as wages. Who are these wage-earners and what are they like? The census figures of ten years ago indicated that over 60 per cent of them were foreigners and the proportion is doubtless larger now, since the general tendency is for the foreign-born to displace the native in coal mining.

What kind of people are these aliens when they come to us; are they experienced coal miners, men who know their job? On the contrary, in his 1916 report, the Chief of the Pennsylvania Department of Mines says,

"Most of the new miners come from southern Europe, many from the agricultural regions populated by the Slavish race, and are without any knowledge of mining and possess little knowledge in other directions." It has been estimated that three-fourths of them cannot speak the English language, and yet it is only recently that there has been any marked interest in the education of the foreign-born. And, strange to say, the present interest has been created chiefly by agencies outside the industries that employ the foreign-born worker.

MINERS FAIL TO UNDERSTAND ORDERS

A manager who would not operate an automobile with a carburetor out of adjustment, or a lathe with a dull tool, permits the condition to exist that miners who might seriously endanger the lives of their fellow-workers and the property of their employer go to work, though barely able to understand the instructions given them by their foremen. What good are safety signs printed in six languages to a man who cannot read in any language?

And what efficiency is there in giving instructions to a man who cannot understand half of what you say? Any manager of a coal mining company who is not urging his local board of education and every other agency to furnish proper educational facilities for the adult illiterate has only himself to blame when ignorance among his employees manifests itself to his disadvantage.

More significant than this is the racial origin of these foreign-born workmen. Do you realize that of the 15 million immigrants who came to the United States in the past 20 years, two-thirds came from countries where the people have for centuries been oppressed by their rulers?

OPPRESSION AND INJUSTICE ARE EXPECTED

There are over 300,000 of such people at work in the coal mines. They have come to us with a background of experience that all they can expect from those in authority over them is oppression and injustice, and that there is no way to achieve their liberty but to fight for it. They come steeped in Old-World superstition and ignorance, many with under-nourished bodies and untutored minds, and we think we have performed the full measure of our duty toward them if we give them a job and the protection of the common law.

They do not understand our form of government and institutions; they are no more qualified to understand them without help than an Indian "medicine man" is to understand modern medicine. Among them are many in whom the native level of intelligence is high, but this may in some instances prove a hindrance, for misdirected intelligence is more dangerous than incapacity.

I have read in the public press that the enemies of

*Paper presented before the February meeting of the American Institute of Mining and Metallurgical Engineers.

†Director, U. S. Bureau of Mines.

organized government in this country have 2,500 paid lecturers who devote their whole time to work among the foreign-born. Have there been 2,500 at work to explain to immigrants what their opportunities and obligations are in this land that has opened its gates to them?

The Bureau of Mines has co-operated with the employing companies in protecting them from accident and disease; we have taken care of their bodies, but who has taken thought for the mind that directs their bodies?

It is astonishing that the managers of mines are not more concerned with the dangers and drawbacks of such a situation.

When recreation and amusement facilities have been provided in mining communities, it has usually been done in order to increase the labor supply in that community, and not with the thought of bettering the quality of that labor supply. A way may be found to keep the mines supplied with cars where-with to move coal, but until a way also is found to keep the mines supplied with miners who understand the language of the country they live in, who have some reasonable idea of its government and their opportunities and obligations under it; who, in short, are members of the community and not an alien element, like sand in sugar or emery in a bearing, the industry will not be on a stable basis.

It is thus imperative to take steps to remedy this condition. Until a more intelligent and systematic effort is made to train the miner for his job, and to give him a clear understanding of the general problem of the business he works for and the community in which he lives, the mine operator cannot hold himself free from blame for conditions such as exist today.

FEW ENGINEERS FOLLOW COAL PRODUCTION

More than 50 years have passed since schools for the training of mining engineers were first established in the United States, and in that period a great number of technically educated men have gone out to take their places in the industry. Remembering that over two-thirds of the people employed in the mining industry are engaged in the mining of coal, it might be reasonable to assume that two-thirds of these technically trained engineers would be found in the coal mining industry; but we all know that that is not the case, and except in the case of those few schools that because of their geographical situation, have unusually close relations with the coal mining industry, it is the exception rather than the rule for the technically trained mining engineer to go into coal mining.

I will not attempt to go into the reasons why this is so, but I want to point out that it is a great disadvantage to the coal mining industry that such a condition exists. Coal mining needs the services of the best engineering talent to solve its many problems.

A short time ago, one of the Bureau engineers prepared at my request a syllabus of problems in the coal industry which need investigation, and it is significant that the majority of these are engineering problems. If

then we have the situation that the problems of the coal industry are largely engineering ones, and that the coal industry is utilizing the services of less than its due proportion of technically trained men, something is clearly wrong.

In many instances we find the men immediately in charge of actual operations are men with only limited education, who have worked their way up through the school of experience to the responsible positions they now occupy. The man who has had only practical training performs important functions in any industrial organization, but there are many others that he cannot adequately perform because he lacks the breadth of knowledge and the sound grasp of the fundamental principles of engineering that are essential to the really

efficient direction of an important and complex enterprise. It is not a matter of salary, because trained engineers on the average are not a highly paid group, and it has been the experience of general business that the economies which an engineer is able to effect more than repay the cost of his services. In my opinion, it will be necessary for the coal-mining indus-

Much time, effort and money have been expended by local, state and national agencies in protecting the life and health of mine workers, but precious little has been done to improve or correct false ideas and incorrect or pernicious habits of thinking. It is as necessary to protect the ignorant alien's mind from the unscrupulous agitator as to protect his body from disease.

try to make a definite attempt to draw into its ranks more trained engineers who will attack its problems with the impartial and scientific method of thought that the engineer is trained to exhibit.

The third thing I want to bring to your attention is the relation of the coal mining industry to the public. Less than 20 per cent of the annual production of coal is used by the domestic consumer, but that 20 per cent governs nearly 100 per cent of the public contact with the coal industry. More than ever before that third party to all industrial adjustment, the public, has to be considered in the solution of any industrial problem.

I have a great faith in the essential fairmindedness of the American public. I believe that at heart the public thoroughly subscribes to the golden rule, and that it is prepared to accord to miners a living wage and to the operator a reasonable operating profit, whatever price of coal that may make necessary, providing the public is convinced that the adjustments made are reasonable and proper.

At present the public does not know what to think. It has an uneasy suspicion that there is something wrong somewhere, but does not know where to place the blame. In a recent public address, the editor of one of the leading New York papers said, "What are the essential merits of the coal strike? Do you know? If you do, you are very fortunate. I don't although I have spared no effort to get at the facts, many of which lie further underground than the coal itself."

According to individual circumstances, some of the public sympathize in a general way with the employer, and others sympathize in an equally vague way with the miners; but none have any clear understanding of the real facts of the case.

One of the things that is most needed in the present situation is an impartial investigation and a lucid exposition of all the factors of the coal industry, so that the public may be informed as to the real facts. Once it is convinced that the prices asked for coal are reasonable

and fair, the public will be willing to pay whatever may be necessary to afford it a regular and assured supply of its source of heat and power.

The engineers of the Fuel Administration are on record as stating that their investigations show that the management of the average coal mine has no adequate knowledge of what its costs of production actually are. I am not speaking of the large, well-managed mines, but of the average mine. A statement like this filtering through to the public is not calculated to convey to the public mind an impression that the coal mining industry is so well managed that there is no room for improvement.

OPPORTUNITY FOR A BIG QUESTION MARK

I should like to call attention to another simple situation. The average citizen calls up his coal dealer and asks him to deliver some anthracite coal, say of nut size. The dealer tells the citizen that this will cost him between \$12 and \$13 a ton (supposing the place in question is Washington, D. C., and a corresponding figure if a different city is involved). This intelligent citizen turns to the report of the Engineers Committee of the United States Fuel Administration and finds chart No. 121, showing the cost of production of anthracite coal during the months of December, 1917, to October, 1918, inclusive. He sees there that over 95 per cent of the anthracite was produced at a cost of \$4.10 per ton or less, and 50 per cent of it was produced at a cost of \$3.60 per ton or less.

It seems clear to me that these two sets of facts will create in any normal mind a large question mark. Who is getting the difference between \$4.10 at the mine and \$12.50 on the sidewalk outside the cellar? Perhaps this citizen has some familiarity with the retail selling of coal, and may even have seen some recently published figures of a large retail firm, which show that yard expense amounts to about \$1.20 a ton, handling losses at \$0.25 a ton, and delivery cost to the customer at \$0.90 a ton; or a total of \$2.35 as the handling cost of the retail dealer.

But this only adds up to about \$6.50 a ton, or about one-half the price paid by the consumer. He knows it costs something to move coal from the mines to the retail dealer, but he has no definite idea of how much it amounts to.

IT IS TIME TO EXPLAIN FACTS

I do not know of any systematic attempt on the part of anybody to explain to the public where the price that it pays for coal goes, and who gets it. Perhaps no one has ever felt that it was their business to do so. It is true that the retailer is the man who is most closely in contact with the general public, but manufacturers in general business long ago came to realize that the problems of the retailer are also their problems, and are undertaking to help the retailer out of his difficulties.

I believe it would be well worth while for coal operators to undertake a publicity campaign for the sole purpose of explaining to the domestic consumer of coal why it costs him as much as it does, for the purpose of removing from his mind the suspicion that someone somewhere is making an undue profit out of his necessities.

I have touched thus briefly on three fundamental factors in the present-day problem of the coal industry. I could go on much longer in the same vein, but it is not possible to here hope to deal effectively with more than

a few definite matters. I have no doubt but that many problems which have arisen and will arise will be adequately dealt with, but after they have been disposed of there will still remain an immense field of work that will continue to demand, and for which I wish to urge, careful consideration.

Some Kansas Coal Fields

ALL mines in the Crawford-Cherokee field of Kansas are operated on the room-and-pillar system. In the southern or Cherokee County portion, the mines are generally wet and non-gaseous, while in Crawford County or the northern section of the field, a contrast is found, in that the mines are generally dry and gaseous. Accidents from gas explosions have been reduced to a minimum in this field through the strict surveillance of the mine inspection department and the absolute enforcement of the state laws relative to gas.

However, some of the miners are still careless about the preparation of their shots and some of the shot-firers are equally as careless about firing them. On the other hand, no shots are fired until all men except the shot-firers are out of the mines at night. No mechanical shot-firing devices of any kind are used, and most of the shots are tamped by the miners. The law requires copper or wood-tipped tamping bars, and prohibits the use of coal drillings for stemming. Shot-firers' accidents have been fewer in the past three years than ever before.

A new coal field is developing in Kansas and it promises well for the future. This is the Le Cygne field in Linn County. It has two beds of coal, each about 30 in. in thickness, one being at a depth of 50 ft. and the other about 30 ft. below the surface. These measures are being worked on the longwall system. The Pleasanton field in Linn County also has promises of a good future. Mining machines and electrical equipment are being installed in the mines in this region, and some excellent longwall work is being prosecuted.

In Leavenworth County there are two or three large mines operated by the longwall system and in Osage County a considerable amount of coal is mined even though the field is on the decline. Some coal is also mined in Franklin and in Neosho Counties by drifts driven into the sides of hills. Wooden rails are used and two or three men work in each drift. Coal is mined in this small way for local consumption in the immediate vicinity.

Kansas coal as a general rule is a good quality of bituminous, and a considerable demand for it always exists. This is evidenced by the fact that when Iowa, Illinois, and other states were only working two or three days a week during the past summer, the Kansas mines were working practically every day.

LIABILITY FOR MINE FOREMAN'S NEGLIGENCE—The owners of a mine operated under the Pennsylvania Anthracite Act by a mine foreman and his assistants, who are required to see that working places are safe, are not liable for injuries to a mine laborer engaged in driving a gangway, where the accident is attributable to an error in judgment by an assistant mine foreman in assuming that a rock in a roof would not fall before the timbering should reach it. (New York Court of Appeals, *Iwanauskas vs. Philadelphia & Reading Coal & Iron Co.*, 124 Northeastern Reporter, 157.)

Fluctuations in Coal Production—Their Extent and Causes*

The "Load Factor" of Coal Production Is "Bad," Particularly in Spots, and the Social Loss Involved Is as Great as That of Universal Military Training—Coal Prices and Freight Discounts Might Correct This

BY GEORGE OTIS SMITH† AND F. G. TRYON**
Washington, D. C.

AN ELECTRICAL engineer has supplied us with the phrase that best expresses what's wrong with our coal industry—it is the "bad load factor." Whether we refer to full rated capacity or to average output, the operation of the soft-coal mines of the country from year to year, from month to month, and from day to day presents a load factor that has been too wasteful of plant and labor and too productive of high costs and uncertain supply. Engineering is needed to determine first how bad the load factor actually is in

supply, mine capacity, and average return to the industry per ton produced, are set forth in curves for the 30-year period 1890-1919. At the base of the diagram is a graphic statement of lost time in mine operation, which is the measure of wasted opportunity for the economic use of both plant and labor.

The statistics thus presented are weighted averages for a greater industry spread over a large country and carried on under conditions that are widely divergent from place to place; these are the facts from the national point of view. Locally the conditions were far better or even worse; yet an exhibit of the trend of bituminous coal production as a whole must necessarily precede any detailed discussion. The 30-year period includes the growth of an industry from an output in 1890 of 111 million tons, from mines whose aggregate capacity

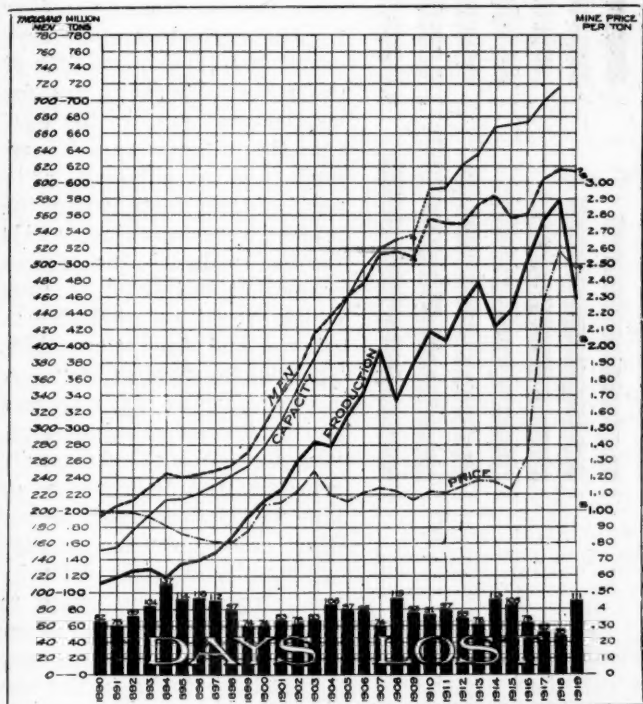


FIG. 1. PRODUCTION, CAPACITY, MEN EMPLOYED, MINE PRICE PER TON AND DAYS LOST AT BITUMINOUS COAL MINES—1890-1919

this basal industry and next how that load factor can be bettered; and with both inquiries there must be combined publicity of a high order.

Those fluctuations in coal production can be regarded as *annual*, which in a large way reflect nation-wide business conditions; as *seasonal*, which express conditions of market and distribution; and as *daily*, which express conditions of labor and car supply. An analysis of this ever-changing rate of output of coal can well begin with a long-range view of the variation through a period of years. In Fig. 1, the facts of coal production, labor

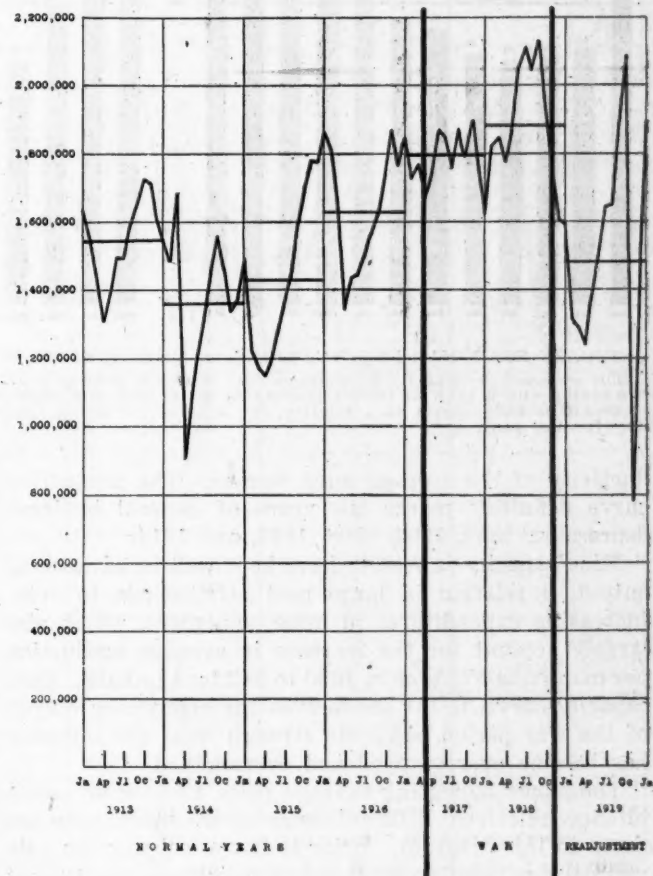


FIG. 2. MONTHLY FLUCTUATIONS IN COAL PRODUCTION

The curve represents the average production per working day for each month from 1913 to 1919. The straight horizontal line across each year is the daily average for the year. The diagram illustrates a combination of two types of fluctuations, annual and seasonal. It also shows how the war demand buoyed up production during the summer of 1917 and 1918. Note the peaks just before the strikes of April, 1914, November, 1919.

*Paper presented before the American Institute of Mining Engineers, New York, Feb. 17, 1920.

†Director, U. S. Geological Survey.

**Fuel Statistician, U. S. Geological Survey.

was estimated at 152 million tons and which employed 192,000 men, to the top figures of 1918, when the output was 579 million tons, the mine capacity was probably 715 million tons, and the mine workers numbered 615,000.

A few only of the outstanding facts may be pointed out in the preliminary study of these graphs. First of all, the coal curve shows more frequent and greater fluctuation than the man curve. The general trend, however, of both these lines, representing coal output and labor employed, has been steeply upward, and the curves have fortunately converged, indicating the greater pro-

but shows itself in the year following the short-time year.

Most significant for the purpose of the present discussion are the blocks at the base of the diagram, representing lost time in the soft-coal industry. In only seven of these 30 years was such lost time less than 25 per cent of the working year. The fact that coal mines are idle for many days each year is familiar to everyone acquainted with the industry in the United States, but what is not generally realized is the amount of time lost. During the last 30 years, out of 308 possible working days a year, the bituminous mines of the country were

idle on the average 93 days. Ten times during that period the time lost exceeded 100 working days. The greatest loss was in 1894 when the average for all mines in the country was 137 days, or 44 per cent of the working year. The smallest loss occurred in 1918, the year of record production, yet even during that year the mines were closed down for one cause or another for the equivalent of 59 days out of 308—nearly one-fifth of the time. These figures for lost time show only the days that the mines were not operated, and absenteeism of a part of the force when the mines were running still further reduced the output below that desirable maximum which would be profitable to miners and operators alike. That is, the figures of "average number of days worked and lost" refer to mine operation but do not necessarily represent the days worked or lost by the average miner. They show only the average opportunity offered to labor by the mines, not the extent to which the individual miner

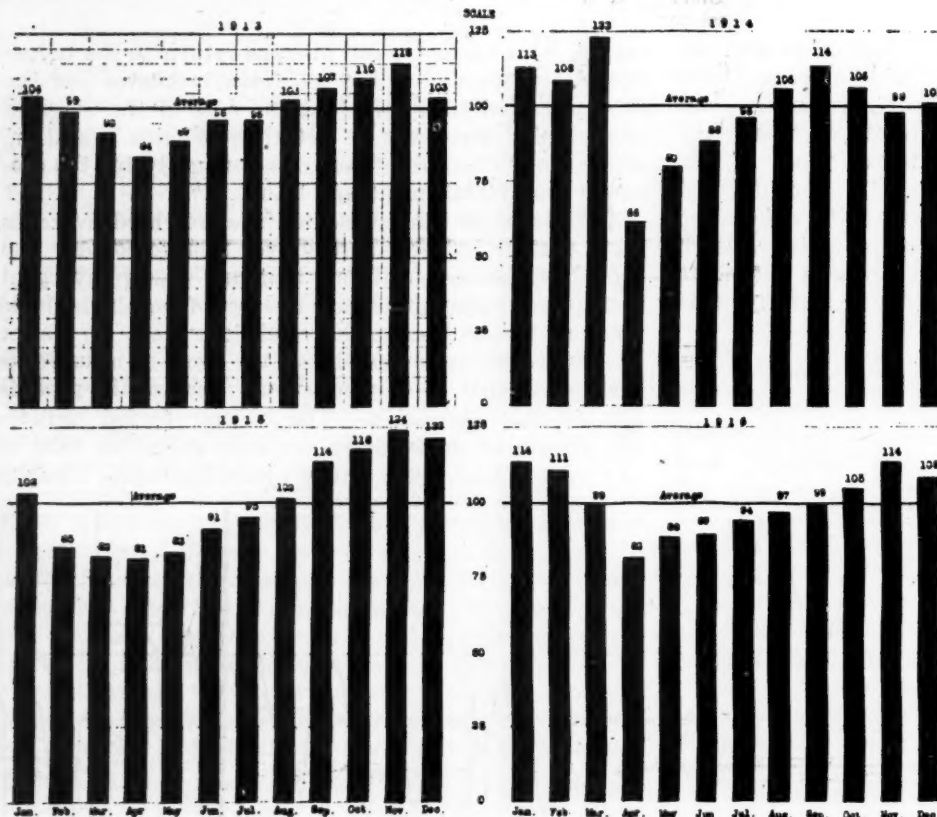


FIG. 3. SEASONAL FLUCTUATIONS IN THE DEMAND FOR SOFT COAL, 1913-1916

The seasonal demand for bituminous coal causes in normal years a slump in production during the spring and a peak of forced production in the fall and early winter. The rate from month to month is here shown as a relative, the base of 100 being taken as the average per working day for the year.

ductivity of the average mine worker. The production curve definitely marks the years of general business depression, 1894, 1904, 1908, 1911, and 1914.

Mine capacity is seen to have kept well in advance of output, a relation in large part attributable to ever-increasing expenditures in mine equipment, which also largely account for the increase in average production per man from 579 tons in 1890 to 942 tons in 1918. That capacity curve, is far above even the emergency output of the war period, suggests strongly that the industry has become overequipped and overmanned.

The curve indicating average price f.o.b. mine seems to show relatively little influence by the other facts set forth in this diagram. Prior to the world war the only marked deviation from a smooth curve was the 12-cent rise in 1903, which was apparently due to the anthracite strike of the previous year. A similar lag is shown for most of the years of general industrial depression, the employee's curve being a year behind in registering the effect of decreased demand. In other words, the exodus from the mine to other employment is not immediate

took advantage of his opportunity. The statistics upon which these statements are based are found in the records of the U. S. Geological Survey's annual canvass of mineral producers, running back for many years.¹ Each mine operator is asked to state the number of days his mine was operated, reducing part-time days to the equivalent in whole-time days. By weighting the replies to this question by the number of men employed the Survey obtains averages for the state and the country. The figures for days lost are believed to be low, if anything.

Returning to the consideration of the 30-year curves we may detect some discordance between production and capacity. The inevitable lag in time between development and active exploitation has a decided bearing upon working time. It means that during the initial period of a time of depression the disparity between production and capacity, which is the cause of poor working

¹The records of the Geological Survey are sometimes at variance with the reports of the state mine inspectors. The cause of at least certain discrepancies is that some of the state averages are not weighted but count all mines alike, regardless of size.

time, increases rather than diminishes. The diseased industry is thus carried by its own inertia into a condition which further aggravates the disease.

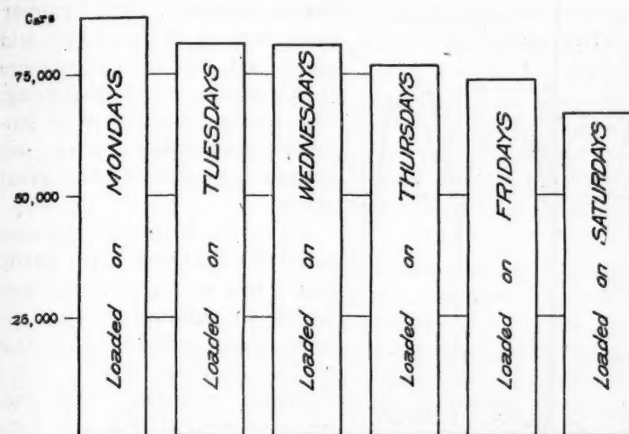


FIG. 4. DAILY FLUCTUATIONS IN PRODUCTION

Not only are there typical seasonal fluctuations in coal production, but there is also a typical fluctuation from day to day during the week, which prevails throughout periods of active demand and is determined by the car supply. The diagram shows the number of cars loaded on each day of the week along the Pennsylvania Lines West, May 20, 1918, to May 3, 1919, excluding holiday weeks. The total number of cars loaded was 472,235.

The fact seems established that there are periodic though irregular fluctuations in working time, resulting first from general business depressions, and second from simple inequalities of growth during periods of unbroken general prosperity. It remains to attempt an estimate of the magnitude of these causes in restricting working time.

It is noteworthy that with two exceptions none of the annual periods of time lost, as shown by the diagram, has been shorter than 74 days during the 30 years covered by the record. The exceptions were the war years, 1917 and 1918, which must be excluded as abnormal. It is also noteworthy that there is a certain regularity about the heights of the columns during the prosperous years. A value of 74-78 occurs seven times, and a value of 82-83 occurs three times. These values point significantly to a figure around 78 or 80 days as the measure of the minimum loss which no ordinary increase in general prosperity is likely to remove. Is not the conclusion justified, then, that losses above this figure are the measure of the effects of annual fluctuations, and that losses below this figure are attributable to some other cause? Expressing the idea another way: if we imagine all the columns beheaded at the 78-day line, the sum of

the cut-off ends would be the measure of the loss caused by annual fluctuations and the truncated stumps below the 78-day line would be the measure of losses due to other causes and these may be called the seasonal and daily losses.

This division of lost time means, then, that out of the average loss of 93 days a year, 16 days were due to extraordinary annual fluctuations in demand, chiefly fluctuations following business depression. This amount of annual as distinct from seasonal fluctuation is not confined to the coal industry, and no help can be found for it short of doing away with business cycles of good and bad years.

There remains, however, that residue of lost time from which no normal year is free. This as yet irreducible residue, as already noted, is from 76 to 80 days, and light on its causes must be sought in the study of seasonal fluctuations in the daily rate of production of bituminous coal, by months, from 1913 to 1919, shown in Fig. 2. For convenience the average for each year is shown as a horizontal line. The general trend may be read by comparing the height of these average lines, and this trend, with its sags in 1914-1915 and 1919, is an example of the annual fluctuations which depend on changes in general business conditions. Superimposed upon this big cycle are a set of smaller fluctuations determined by the seasons. For the pre-war years 1913-

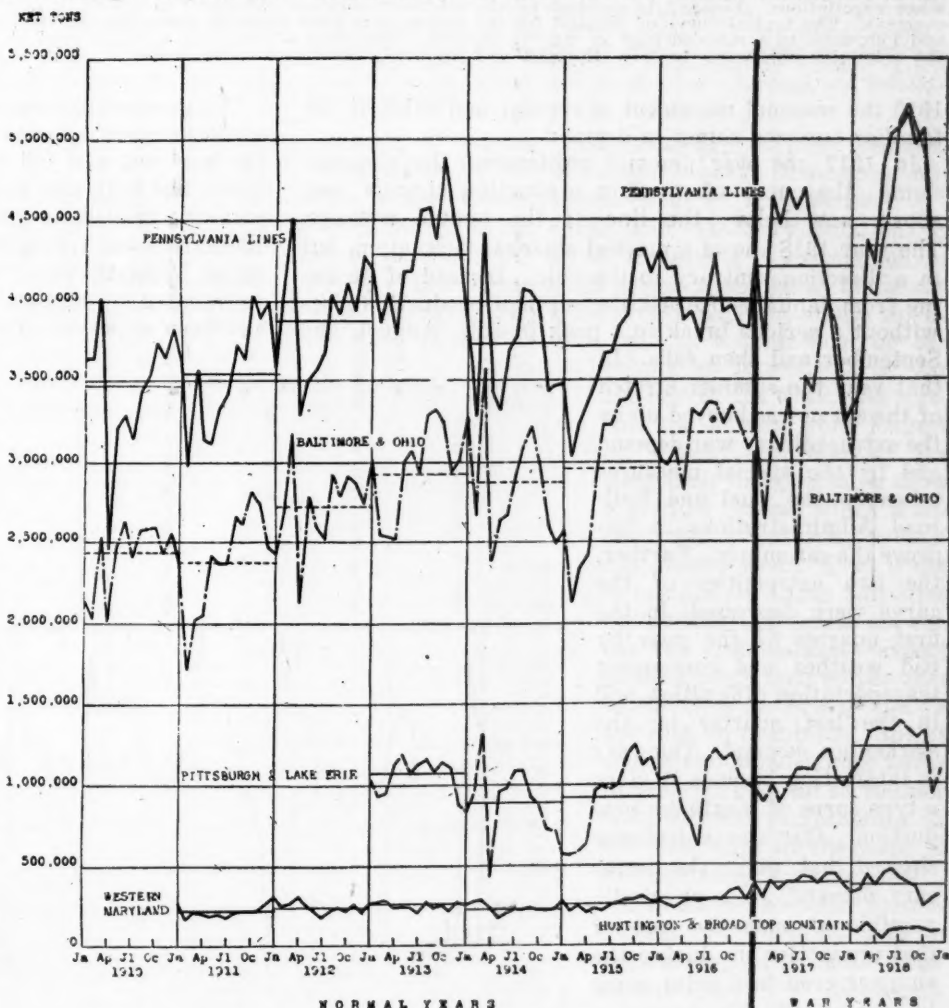


FIG. 5. SEASONAL FLUCTUATIONS IN SOFT-COAL SHIPMENTS, 1910-1918

The movement out of the Northern Appalachian region is here illustrated by shipments on certain carriers. Although demand in this region is steadied during the summer by shipments to the Lakes, it has a decided seasonal rhythm. In normal years the market sags in April and thereafter rises gradually to a peak in October, November and December. Another peak of forced production occurs in March of the even years, reflecting apprehension of purchasers over the outcome of the biennial wage negotiations.

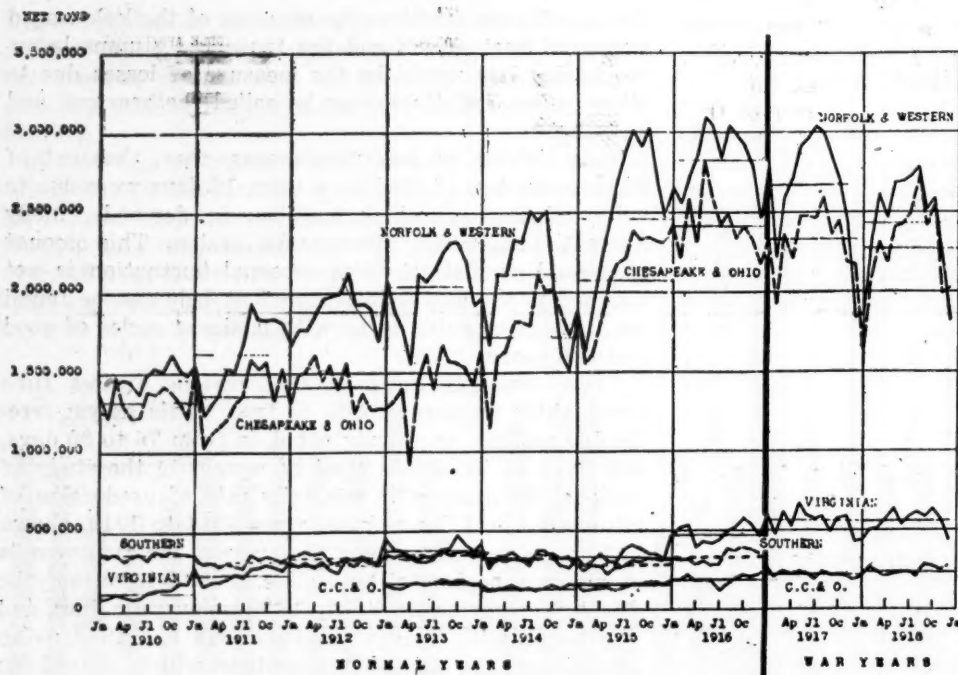


FIG. 6. SEASONAL FLUCTUATIONS IN SOFT-COAL SHIPMENTS, 1910-1918

Movement out of the Middle Appalachian region is here illustrated by shipments on certain carriers. As the region is largely non-union the monthly shipments do not show the rugged March peak and profound April sag characteristic of union fields in the years of the biennial wage negotiations. Demand is steadied by the relatively constant movement to tide for export overseas. The typical curve of demand for the region rises from a low in December, January, and February, to a rounded high in May to October. The locus of the high is determined by the tidewater shipments to New England and the heavy movement to the Lakes.

1916 the seasonal movement is regular and exhibits the familiar summer slump in demand.

In 1917 the war demand obliterated the seasonal slump; the curve of monthly production zigzags now above, now below, the line of the annual average. The year 1918 shows a marked seasonal fluctuation, but in a direction contrary to the rule. Instead of declining from January to April, the curve of production rises without a serious break to a peak in July, August, and September and then falls. In that year the summer stretch of the curve was buoyed up by the extraordinary war demand and by the special measures taken by the Fuel and Railroad Administrations to improve the car supply. Further, the two extremities of the curve were depressed, in the first quarter of the year by bad weather and consequent transportation difficulties, and in the last quarter by the slackening demand. The year is interesting because it gives a type curve of maximum production. Our war experience showed that, given the necessary demand, it is physically possible to push the rate of coal production up during the summer even to a point much in excess of the maximum winter rate.

The 1919 curve is in part true to type, in part exceptional. It exhibits the spring

The greatest extremes shown in the diagram occurred in 1914, when the rate of production rose in March to 123 per cent and fell precipitately in April to 66 per cent. The high was thus nearly twice the low. In that year two influences were at work: the normal seasonal fluctuation was intensified and distorted by the biennial wage negotiations. The normal April slump was aggravated by strikes, in anticipation of which there had been a period of anxious buying in March. The

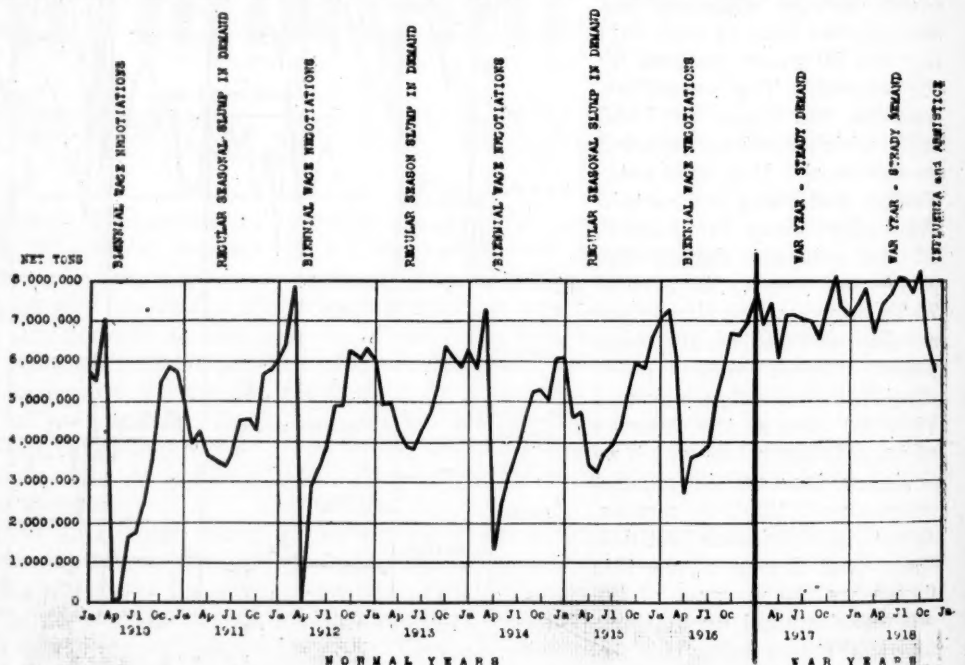


FIG. 7. SEASONAL FLUCTUATIONS IN THE DEMAND FOR ILLINOIS COAL, 1910-1918

Demand for Middle Western coal is here illustrated by the monthly production of Illinois. Middle Western producers are not benefited by the movement to the Lakes and to tide which steadies the demand for the Northern and Middle Appalachian coal. In consequence they have to meet a peak of forced demand from September to January, followed by a terrific depression from April to July. In the years of the biennial wage negotiations this April depression often plunges production to zero. It is then preceded by a month of feverish buying in March.

and summer depression, accentuated by the necessary readjustment of business after the armistice. Its October peak was both hastened and steepened by the knowledge that a strike was threatening. The profound collapse of November-December was of course the effect of the great strike.

In order to study the seasonal fluctuations more easily Fig. 3 has been prepared, from which the annual fluctuations have been isolated and cast aside, leaving only the monthly changes. The two pre-war years 1913 and 1914 are typical. Each black column shows the rate of production per working day for the month represented, expressed as a percentage of the average for the year. Thus the figure 104, at the top of the column for January, 1913, means that the rate of production during that month was 4 per cent above the average for the year.

year may be taken as a somewhat exaggerated type of the fluctuation to be expected in an "even" year—the year of biennial wage adjustment. In one respect, however, 1914 was not typical. The autumn peak came in September and was followed, in the last quarter of the year, by a depression which marks the effect of the outbreak of the European war. In other years the peak was reached in November. In 1916 the peak measured 114, in 1913 it reached 115, and in 1915 the rush of Allied war orders carried it up to 124. The month of smallest production in each year was April. Except in 1914, when strikes carried it down to 66, this April low has been about 82.

The year 1913 may be accepted as a fair type of the odd year, when monthly variations represent seasonal fluctuations in demand only, uninfluenced by labor disturbances. In such a typical year the capacity required during the month of maximum demand will be from 35 to 40 per cent greater than in the month of minimum demand. In other words, a mine capacity and a labor force, if working full time, sufficient for November, would be employed in April only 70 to 75 per cent of the time; and as in actual practice the mines never attain 100 per cent, or full time, even in November, but under the very best conditions reach only 80 per cent, the time of employment which may in fact be expected during April is about 58 per cent.²

To put it another way: even in years of active demand the present inequalities in the summer and winter buying of coal render inevitable a long period in which the labor and capital engaged in the industry can not work more than 27 to 30 hr. out of a 48-hr. week. Let no one regard this as a condition to be accepted as the

²The rate in April, 1919, was only 50 per cent of full time, or 24 hr. out of a 48-hr. week. The highest percentage of full time ever averaged by the bituminous mines of the country for one week was 86.8, during July 7-13, 1918. The average for that month was 84.4 per cent. In September, 1918, an average of 84.9 per cent was reached. In November, 1917, however, when demand was intense but the zone system and other features of war-time control of distribution were not in force, the percentage averaged was only 75.3. It does not seem probable that with present transportation facilities the percentage of operation attained in November will be much in excess of 80.

FIG. 9. EFFECT OF IRREGULAR WORKING TIME UPON COSTS

This diagram, clipped from the Report of the Engineers' Committee of the United States Fuel Administration, is the first statistical analysis of the actual effect which interruptions of working time have upon costs. The diagram is based on the monthly records of 73 operators in the New River district of West Virginia, who produced 7,231,343 net tons of coal in 1917.

The particular cause of lost operating time here selected for analysis was car shortage. Other causes, such as mine disability or dull market, would doubtless have increased costs in the same manner. It is the interruption to operation, not the cause of the interruption, which raises costs.

The diagram shows quantitatively what everybody knew before in a qualitative way—that irregularity of operating time means higher costs per ton produced.

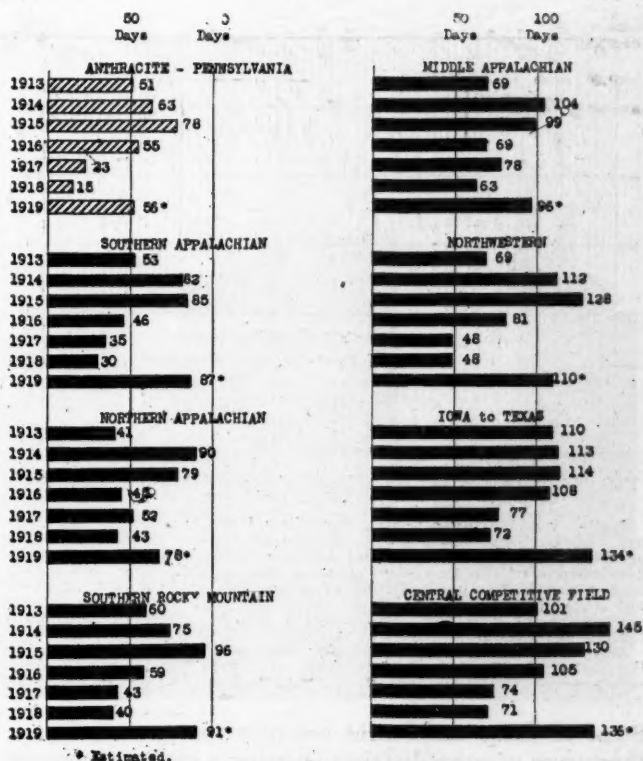
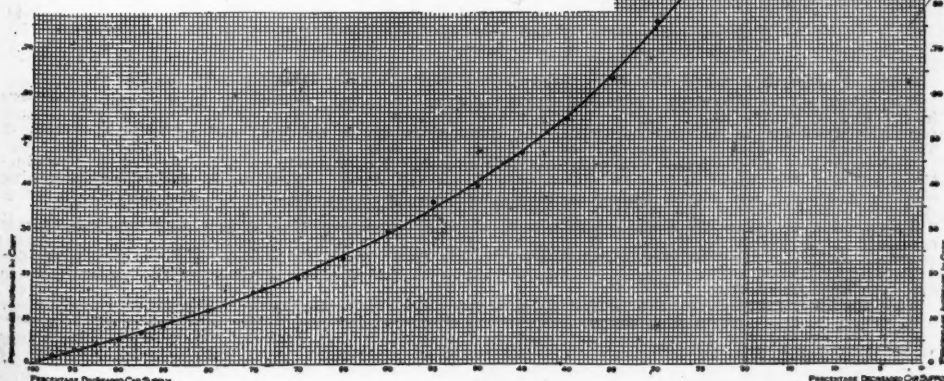


FIG. 8. DAYS LOST PER YEAR—ANTHRACITE AND SEVEN BITUMINOUS REGIONS

Losses in working time vary greatly from one field to another. In this diagram anthracite and seven great groups of bituminous mines are compared. Each bar represents the number of idle days for the field and year in question. Sundays and holidays are not counted.

measure of working time necessary to meet demand. As a matter of fact the 30-hr. week is the spring ailment of the bituminous coal industry, not its cure.

In addition to the annual and seasonal fluctuations in production, a third set of variations is exemplified in Fig. 4. The railroad works seven days a week; the mines work six days. Over Sunday the carrier catches up in its work of placing cars, and in consequence the car

supply on Monday is by far the best of the week. As a result the miners work longest on Monday, but later in the week their hours of labor show a gradual decline, which is accentuated on Saturday by holiday absenteeism. Even if the mines should attain full time on Monday they could not under the circumstances expect to work more than 86 per cent of the time on Friday and 79 per cent on Saturday. But of course the Monday rate never in practice gets up to 100 per cent, and the performance on the later days of the week is correspondingly defective.

The data on seasonal fluctuations so far presented apply to the country as a whole. The typical curve of production for the United States is in fact a composite of a large number of other curves, which differ widely from field to field.

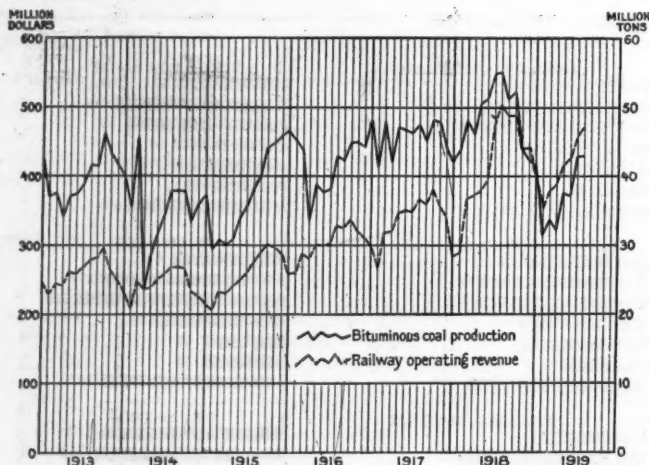


FIG. 10. RAILWAY REVENUE AND BITUMINOUS-COAL PRODUCTION

Railway operating revenues for Class I roads and large switching and terminal companies are represented by the dotted line; production of bituminous coal by the solid line. The monthly fluctuations of the two show a close correlation. The correlation is due partly to the influence of common causes affecting both, but very largely to the fact that soft coal contributes about one-fourth of the ton-miles carried and a sixth of the total freight revenue.

Improving the "load factor" for the coal mine would improve the railroad's "load factor" as well. It would furnish more equal employment for the one and a third billion dollars invested in coal cars.

Some of these differences are only matters of degree, the curves of some districts showing a more pronounced slump than those for others, but in still other cases the curves are unlike and the differences tend to neutralize one another and so to smooth out the composite graph.

Figs. 5, 6 and 7 give type curves for the northern and middle Appalachian regions and for the State of Illinois, and a comparison of these curves suggests how much more acute the problem of seasonal demand is in some districts than in others. Contrast for example, the great valleys and peaks of the Illinois curve (Fig. 7) with the even curve for mines along the Western Maryland Ry. (Fig. 5.)

A further contrast distinguishes the union from the non-union fields. Illinois and much of that part of the northern Appalachian region covered by Fig. 5 show in the even years a profound drop in April, which marks the biennial wage negotiations. The slump is regularly preceded by a period of active buying, which often makes the March production the highest of the year. This effect is largely absent from the curves of the railroads of the middle Appalachian region (Fig. 6) which serve for the most part non-union mines.

Another notable fact is the manner in which the fluctuations for different regions tend to neutralize one another.

The Chesapeake & Ohio and Norfolk & Western curves, for example, seem to start upward in February and March, at the very season when the Illinois curve has begun its dive downward. To combine the two in the course of getting a composite curve for the country would yield a much flatter graph than either exhibits alone. The average for the country thus does not at all reveal the full extent of the disease from which the industry suffers. We have merely charted the average temperature of a number of patients in which the severe chill of one patient is offset by the high fever of another. This all-country curve seems discouraging enough but it in fact conceals much local trouble, and any remedy that is to better the operating conditions of both the miners and the owners must be applied in terms of local, not national fluctuations. To find this remedy further study of the district fluctuations is therefore essential.

The peculiar shape of the middle Appalachian curve is determined largely by the movement of coal to the Lakes for consumption in the Northwest. The Lake movement has as its limits April 15 and Dec. 1, and this necessarily exercises a wholesome influence on working time in Ohio, western Pennsylvania, West Virginia, and to some extent, eastern Kentucky.

The curve for Illinois (Fig. 7) illustrates seasonal fluctuation at its worst. During the "odd" years the demand in the slack month sinks to half what it reaches at the peak, and during the "even" years the production in April approaches zero. The causes of the summer slump are twofold. In the first place, the natural market

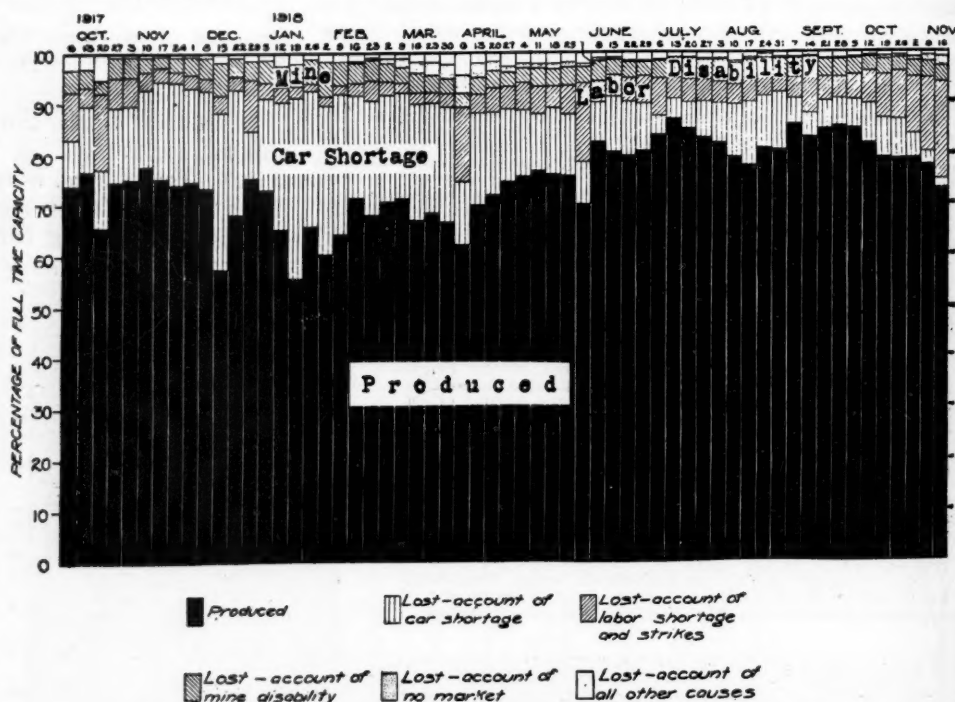


FIG. 11. THE CAUSES OF LOST TIME—WHEN DEMAND IS ACTIVE

The diagram summarizes operating conditions as reported weekly by bituminous producers in the United States from October, 1917, to the Armistice. Full time of 48 hours is represented for each week by an upright column. The black segment is the per cent of full time worked. The shaded segments represent per cent of full time shut down for specified causes.

The period covered was one of very active demand. No market, as a factor limiting production, affected the West only. It appears as a narrow lens, beginning in February, widening slightly in March and April, and contracting again to a mere slit through the summer months. A further softening of the western market began just before the Armistice.

Losses due to labor were generally small, seldom exceeding 4 or 5 per cent. Larger losses occurred in the following weeks: October 20, 1917—strikes in Illinois; December 29—Christmas; April 6, 1918—miners' holidays and Liberty Loan Day; June 1—Memorial Day, and July 6—Independence Day. The influenza epidemic accounts for the broadening of the labor zone in October and November, 1918.

The limiting factor over the period as a whole is revealed in the broad zone of car shortage and other transportation disability.

The record for the period was attained in the week ended July 13, 1918, when the mines worked 86.8 per cent of full time. On the basis of a 48-hour week this was an average of 41.6 hours.

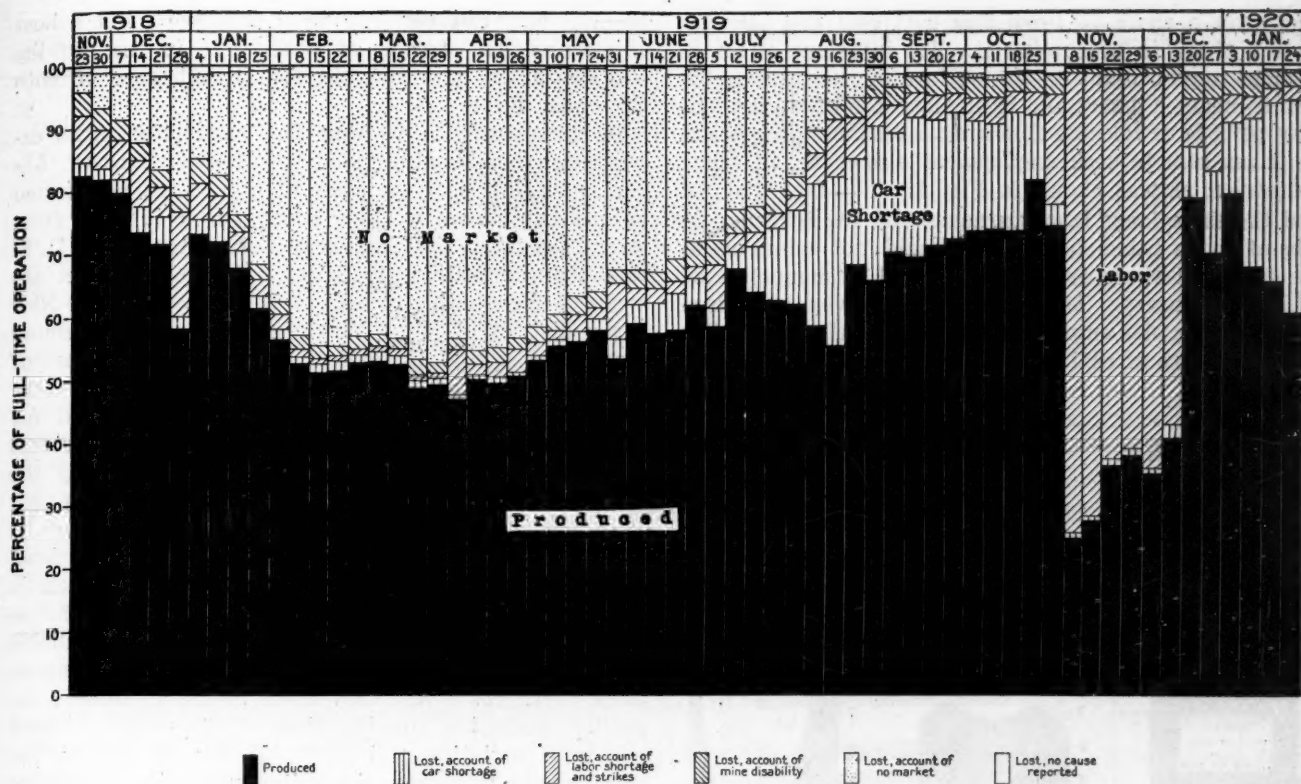


FIG. 12. THE CAUSES OF LOST TIME—WHEN DEMAND IS SLACK

The diagram summarizes operating conditions reported weekly by bituminous producers from the Armistice to January 24, 1920. The outstanding features of the period were the pronounced slump in demand which followed the war and the great strike. Transportation disability did not assume significant proportions until August, 1919. Since then, except for the strike period, it has been the dominant factor limiting production.

for Illinois coals, as limited by transportation costs, is one in which domestic consumers rely largely on bituminous coal, and of all classes of demand that of domestic consumers fluctuates most with the seasons. Into that market, unfortunately, the steadying effects of the Lake and New England movements and of overseas exports do not enter. In the second place, the nature of Illinois coals places them at a disadvantage in competing even within this, their natural market. They do not store easily, and up to the present time they have not found favor with coke makers and therefore do not feel the steadying influence of the demand for coke.

Any industry that offers its labor and its capital an employment as irregular as that expressed by the Illinois curve is laboring under a great handicap. And yet the Illinois curve is roughly typical of the production for the whole Mississippi Valley region, from Indiana to Iowa and south to Arkansas. Some 175,000 miners and 28 per cent of the mine capacity of the country operate under a curve of this type.

The statement of lost time by districts further emphasizes this regional variation. Fig. 8 shows the averages for the seven grand subdivisions of the bituminous fields, to which is added, for comparison, the anthracite region of Pennsylvania. The figures given represent the real losses of potential working time, each day lost meaning a cut in the actual productive capacity of both mine and miner.

It is perhaps significant that there is a rough relation between the loss of working time and the degree of unionization. Those bituminous regions in which interruptions to operation are most pronounced show a tendency to become union territory. The presence of the union is both cause and effect. Wage disputes cause lost time; but, on the other hand, irregular employment

is in itself a prime incentive to unionization.

During the seven years shown in the diagram each of the bituminous regions has lost more time than the anthracite country. By regions the 7-year average has been as follows, arranged in order of time idle:

Region	Days Worked	Days Idle
Anthracite	260	48
Southern Appalachian	248	60
Northern Appalachian	247	61
Southern Rocky Mountain	242	66
Middle Appalachian	225	83
Northwestern	223	85
Iowa to Texas	204	104
Central competitive field	199	109

The fact of irregularity in working time is thus indisputable, and its extent is shown to be everywhere great, while everywhere it reacts unfavorably upon all

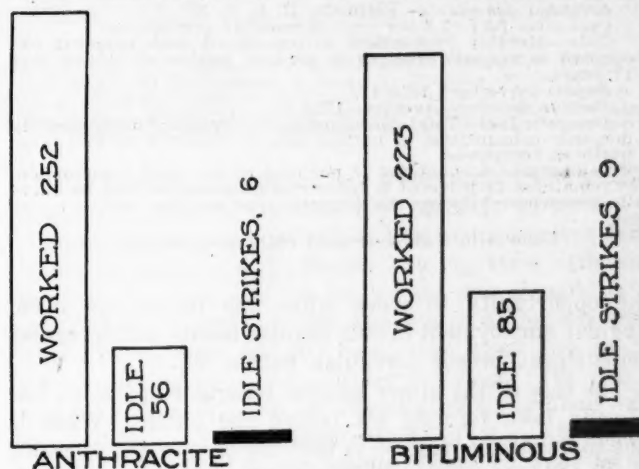


FIG. 13. STRIKES IN BITUMINOUS AND ANTHRACITE MINES, 1910-1918

This shows the average for all bituminous and all anthracite mines in the United States during the nine years, 1910-1918. Days idle include strikes. Ten and seven-tenths per cent of the time lost in anthracite mining was due to strikes, and 10.6 per cent in bituminous mining.

who have a share in producing soft coal and all who have a share in consuming it. Its injurious effect is perhaps most evident on the welfare of the miner. To him it means a direct and immediate loss of wages. In long periods of idleness following a business depression it drives him to seek employment elsewhere, in other industries, as was shown in Fig. 1. The fact that we find the same large labor turnover and the tendency to migration in other industries should not blind us to the fact that these are causes as well as symptoms of industrial unrest. The question may even be raised whether irregular employment is not largely responsible for the failure of coal miners to take full advantage of

on—not only interest charges and salaries, but a host of maintenance charges as well. And in the end the coal consumer pays the bill for the idleness of both miner and mine.

In this connection we may find instruction in an exceedingly valuable study made by Messrs. Garnsey, Allport, and Norris of the costs of production as affected by interruptions of working time. Fig. 9 is taken from their "Report of the Engineers' Committee of the U. S. Fuel Administration, 1918-19." It represents an analysis of the monthly records of 73 operators in the New River district of West Virginia. The diagram shows that there is a mathematical relation between cost of production per ton and decrease in working time. The special cause of irregular working time selected for analysis was car shortage, but any other cause of loss would presumably have affected in the same way the cost per ton. The reason for the increased cost per unit of output is, of course, that the smaller the number of tons produced the larger the share of the fixed overhead expenses which must be borne by each ton. Francis S. Peabody, testifying before the Frelinghuysen committee on Sept. 4, 1919, stated that "the earnings of the laborer and the cost of coal depend entirely upon continuous work. Our costs will vary from month to month, dependent upon the running time of our mines. There will be a variation of between 50 and 60 cents a ton from month to month, depending upon the number of hours the mines are idle."

The effects of fluctuation in coal production on our transportation system can readily be appreciated. The coal mine is the railroad's largest shipper, and the railroad in turn is the largest consumer of coal; in fact it has been remarked that coal is the nucleus around which our railroad system is built.

When the operator experiences a car shortage he is prone to blame the railroad for what he regards as a failure to meet its obligations. He does not realize, perhaps, that the railroad suffers from the seasonal fluctuations in coal production as well as the coal-mining industry, for in its business of selling transportation to the coal producer the railroad meets the same seasonal demand that the producer meets in selling coal to the retailer. An investment in coal-carrying equipment sufficient to transport all the coal that the mines can produce in November would in large part lie idle during the slack season of summer. The depreciation of a coal car standing idle on a siding is perhaps no less serious than the depreciation of the idle mine. When we remember that there are approximately 925,000 coal cars in the country, and that the capital invested in these cars is roughly one and a third billions,* we can visualize the cost to the railroads of a long period of car unemployment. If the mine owner has his car shortage, the railroad man has what might be called his "freight shortage." The capital investment in coal-carrying equipment alone is of the same order of magnitude as the capital investment in coal-mining, and it is no less desirable to provide constant employment for railroad capital than for mine capital.

The relation between the monthly volume of coal shipment and the corresponding level of railway earnings is shown in Fig. 10. The dotted line representing railway-operating revenue shows a seasonal periodicity that

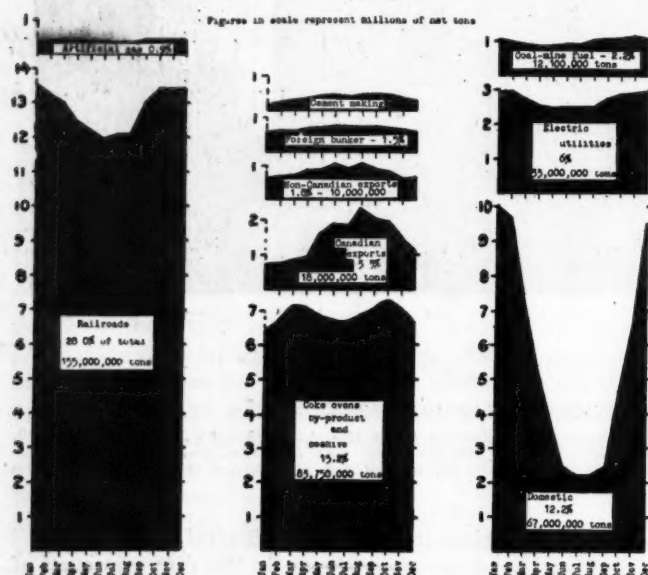


FIG. 14. TYPICAL CURVES OF MONTHLY BITUMINOUS CONSUMPTION

The above diagrams suggest the probable monthly consumption of soft coal by certain users during a year when the total production amounts to 550,000,000 net tons. They are presented as tentative and subject to sweeping revisions. Although much is known of the total annual consumption of coal by individual industries and by localities, very little is definite known as to how the annual total is distributed over the 12 months of the year. The Geological Survey offers these curves simply as a basis for discussion and as an example of a type of inquiry which it is believed will be of value and which the Survey hopes to pursue further.

The basis for the curves presented is briefly as follows:

Railroads—Monthly consumption records, Fuel Conservation Section, U. S. R.R. Administration, 1913-19.

Electric utilities—Studies of Division of Power Resources, U. S. G. S.

Artificial gas plants—Estimate, U. S. G. S.

Coal-mine fuel—2.2 per cent of monthly production.

Coke—Monthly fluctuations to correspond with seasonal (as opposed to annual) changes in pig-iron production during last 12 years.

Export—Average, 1913-17.

Foreign bunker—Average, 1913-19.

Domestic fuel—Total consumption to correspond with monthly domestic consumption of natural gas, as reported by two large northern companies.

The diagrams account for 72 per cent of the total consumption. The remaining 28 per cent is industrial consumption and its curve falls somewhere between the domestic type and the electric-power type.

Figures in scale represent millions of net tons

the opportunity to work when the mines are open. Regular employment breeds regular habits and irregular employment breeds irregular habits.

The case of the miner against irregular operation has already been forcibly set before the public. What is not so generally realized is that the case of the operator is just as damaging to him. When his operation is shut down his capital is idle, and his mine equipment instead of benefiting by a rest, is rapidly depreciating. Although the mine shuts down, his fixed charges run

*The railroad statistics here presented are in part estimated, and were employed after consultation with the Bureau of Railway Economics, Washington, D. C.

closely follows the peaks and valleys in the curve of bituminous coal production. The marked correspondence between the two curves is in part at least to be attributed to the effect of common causes at work upon both. But when it is remembered that coal is about one-third of the total tonnage carried by the railroads, and that about one-fifth of their total freight revenue is derived from it, the conclusion is unavoidable that seasonal fluctuations in coal production affect profoundly the earning power of the carriers.

A complete analysis of the effects of the irregular operation of the coal mines would include references to the coal dealers, both wholesale and retail, but the consumer is of course the one whose purse suffers most, for in the long run he pays for all the wasteful practices. He must support the miner for not only the 215 days that coal is coming from the mines but also for the 93 possible working days when the mines are closed.

The immediate causes of these seasonal fluctuations are car shortage, labor shortage, mine disability, and "no market." The varying values to be assigned to all these causes are shown in Figs. 11 and 12.

STRIKES ARE COMPARATIVELY UNIMPORTANT

The minor importance of strikes in affecting the amount of lost time is shown in Fig. 13. The average number of days lost by reason of strikes for the mines of the whole country, both anthracite and bituminous, during the 9 years 1910-1918, was less than 11 per cent of the whole time lost. This is not, of course, a measure of the losses incurred locally in certain years, but it shows that other causes have had wider and more persistent effect upon the working time of the mines.

Any statement of the extent and causes of the fluctuations in coal production lacks vision unless it at least faces the search for a remedy. The limits of the statistical summary permit only suggestions, and these, although not novel, are probably worth the attention of everyone who attacks the problem of stabilization. Plainly fluctuation in production expresses to some extent fluctuation in demand.

An attempt to study the degree to which different consumers affect the seasonal market yielded the group of consumption curves given in Fig. 14. The seasonal fluctuation in locomotive consumption is seen to be a factor, for the railroads consume 28 per cent of all soft coal mined. An even larger offender in degree is the domestic consumer, although the amount involved is much smaller. The general industrial user doubtless ranks next as a contributor to the seasonal fluctuations, but the public utilities present a much more even curve, and the curve for the iron industry is somewhat the same. Fortunately, in the case of certain other consumers, such as the cement and clay-products industries, the summer coal consumption exceeds the winter and the effect on the general production curve is beneficial. Export and bunker trade and the Lake shipments likewise tend to smooth out the seasonal curve.

The line of attack for the betterment of seasonal demand therefore seems to be narrowed down to a few classes of consumers. The problem of improving the load factor for the coal mines thus becomes a problem of encouraging the summer buying of coal. Two meth-

ods of solving this problem have been suggested: Seasonal discounts of the coal price and seasonal freight rates. Both methods seem economically sound and both will doubtless be fully discussed. Fig. 15 presents a comparison of lost time in the anthracite and bituminous mines since the summer discount was introduced for anthracite. It will be noted that the present advantage of the anthracite mines did not immediately follow the new system—the consumer has to be educated even to serve his own interests. A seasonal discount in freight rate seems wholly justified by the railroad's interest in its own load-factor; it too can afford to bid for summer traffic in preference to the more expensive winter haul.

But these or any other methods of increasing summer buying of soft coal cannot be considered apart from the question of storage; to what extent can storage be made practicable and to what extent can it be made attractive to the consumer, large or small?

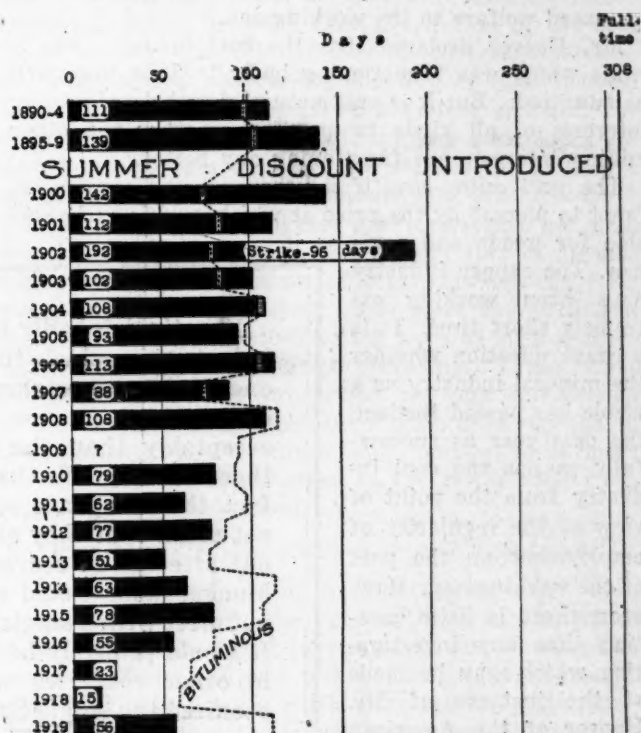


FIG. 15. DAYS LOST IN ANTHRACITE MINING BEFORE AND AFTER THE INTRODUCTION OF SUMMER DISCOUNT

In 1902 the "companies" in the anthracite region inaugurated the policy of announcing a summer discount on domestic coal. A gradual reduction in time lost followed. In the diagram the black bars represent average number of days lost. The zigzag line shows the losses in bituminous mining over the same period.

The general interest of our whole nation in bettering the load factor of the soft coal industry is large. Irregular employment is both a loss in man-power and a cause of social unrest. Society can not view with equanimity the spectacle of an excess mine capacity of 150,000,000 to 200,000,000 tons, and an excess labor force of perhaps 150,000 men. We hear talk of the social cost of universal military training. The cost of the man-days of enforced idleness in bituminous mining, during an ordinary year, is as great as that which would be involved in giving the year's class of all the young men of the country three months' military training.

To stop this industrial leak, together with its attendant evils, is the task of the engineer.

*The curve for the iron industry represents only the average seasonal fluctuations for the last 12 years. The annual fluctuations caused by variations in general business activity have been isolated and cast aside. As the annual changes are far more pronounced, the seasonal changes are often obscured.

Conference Seeks to Cure All Mine Ills

Describing the Coal Industry as "One Which Functions Badly," the A.I.M.E. Boldly Accepts the Responsibility of Setting It Up on Its Uncertain Feet

BY R. DAWSON HALL

PERHAPS few sessions of the American Institute of Mining and Metallurgical Engineers have been more full of interest and instruction, or more generally attended, than those which were held in the auditorium of the Engineering Societies Building on Feb. 17 and 18.

It is hoped by Herbert C. Hoover, the president of the American Institute of Mining and Metallurgical Engineers, that as an outcome of the movement started by this discussion of the situation by engineers the stabilization of the coal-mining industry may be effected and so be a source of prosperity to the country and of increased welfare to the workingman.

Mr. Hoover declared that the coal industry was a trade which was "functioning badly." That may well be admitted. But it is only natural for the coal-mining interests of all kinds to question whether the other mining interests are functioning any better.

The gold mines are, if we may use the expression, "shot to pieces" by the price at which gold is exchangeable for goods and services. The copper industry has been working extremely short time. It is a grave question whether the mineral industry as a whole has passed through the past year as successfully as has the coal industry from the point of view of the regularity of employment on the part of the workingman. However, there is little question that any investigation which may be made at the instance of Mr. Hoover of the American Institute of Mining and Metallurgical Engineers will be of a sympathetic and helpful character.

When some institution like the A.I.M.E. is preparing to do the industry a favor I suppose the industry should not be too careful to see from whom the gift comes, or to deny that it is a gift, just simply because the persons who tender it are in need of like help themselves. There is no question but that the metal industry in general needs to look into its situation as carefully as it does into the status of the coal industry. We may look confidently to a time when it will be the duty and privilege of the coal-mining industry to show the copper, zinc, lead, gold, silver and precious metals, and other like industries, how they can best arrange their affairs so as to keep their equipment busy and their miners steadily at work.

One cannot but feel that the trouble in the coal industry arose from two sources (1) the scarcity of demand for coal and for the work of the miner during the early months in the year, and (2) the plentitude of demand for coal and for the labor of the miner during the final

months of the year. Men do not complain until they see that economic conditions are such that it is perfectly safe for them to rebel.

In the metal industry there is such a small demand for the minerals which are now being produced that the metal miners are perforce obliged to be satisfied, but just as soon as there is a shortage of product in comparison with the amount used, we shall find that the metal miners can make as much complaint as anybody about the shortness of time which was vouchsafed to them in the year 1919. Then we shall learn that the metal industry is functioning badly.

H. C. Hoover opened the meeting on Tuesday, Feb. 17, at 2 p.m., with Horace C. Winchell presiding. He outlined the needs of the industry in a broad way, being followed by Van H. Manning, who made an address under the title of "Problems of the Coal Industry." His address appears in this week's issue. This was followed by a presentation of the fluctuations in coal

production, their extent and causes, delivered by George Otis Smith and prepared by him in collaboration with F. G. Tryon. As this is also a matter of record in another part of this issue, it is entirely unnecessary to make any reference to it here. Sidney J. Jennings, a past president of the American Institute of Mining and Metallurgical Engineers and president of the United States Smelting & Refining Co., while not taking issue openly with Mr. Smith on the question of the excess of mine labor

Functioning badly is a common fault of all industry, in which the coal business is only one of many partakers. And the metal industry is just now functioning even less acceptably than the coal trade. However, there are some ills that need correcting. The fact that they are somewhat common does not mean that they should be accepted without attempt at redress. A suggestion that Mongol labor would rectify the problem did not meet with a single expression of approval. It would probably be as unfortunate here as in other countries where cheap labor has peonized the Anglo-Saxon mine worker.

in the United States at the present time, stated that during the war he was much troubled with the fact that at many of his mines most of the coal was mined by foreigners who belonged to 27 different nations and spoke 8 different languages. What was worse, many of them were enemy aliens. In consequence he had expected that there would be much difficulty in providing the mines with a sufficient and willing labor force.

He stated that there was difficulty in getting men to supply the increased tonnage which was demanded year by year, and he suggested that, in China, men could be obtained who would do the rough work of mining. He stated that during the war he had offers from representatives of the Chinese in this country who volunteered to provide men should the Government permit their introduction. He mentioned the success with which the Chinese had been brought into the mines of South Africa for a limited period of time, the understanding being that they were to stay not less than three years and not more than six. He thought that

the arrangement which was made in the Transvaal might be one which the United States could advantageously follow.

While Mr. Thacher succeeded Mr. Jennings, perhaps it would be well to delay comment on his remarks, to state that Mr. Hoover protested against the introduction of Chinese into this country under any contract or no contract. He said it was impossible to mix the yellow race with the white, and that the question was not one of economics but one of real national existence.

In Natal Asiatics had been brought in, and as a result there are now three classes—a sort of patrician class, an Asiatic class and persons who might best be described as “white trash.” There was no question but that it had caused stratification of the people of the Province of Natal, creating a patrician class and a body of citizens whose misfortunes and standing were of the character which branded them as “peons.”

METAL MINE WORKER MAKES 10-TON DAY

Arthur Thacher of St. Louis, Mo., who operates zinc and lead mines in Wisconsin, stated that the coal mines in Illinois were producing only about four tons per man, whereas the zinc mines in Wisconsin were producing ten tons per man per shift. He stated that this was due to the lack of co-operation between the coal miners and their employers, and stated that though coal was twice as bulky as ore the miners could, if they wished, produce much more coal per day.

He stated that in certain districts where the union did not have the authority that it had in the more important mining sections, the miners would put out about 20 tons per man per day. In those sections of the country each man did the best he could, but in others they limited their production so as to have an excuse for raising the rate of pay. He added that in his zinc mines he had a man 53 years old. Asking him how much he had loaded, he was informed that he had placed in the cars that day 75 tons. He had done as much the day before, and his neighbor had loaded 100 to 110 tons, 112 tons being his highest record. One man in one year loaded 15,000 tons.

George Otis Smith stated that the Asiatics in South Africa loaded 15 tons in 25 days, and that in view of such a record as that he thought that there would be very little advantage in the introduction of Asiatic labor. Asiatics do not seem to have the capacity which is to be obtained from workingmen such as North America and Europe will provide.

ARGUES THAT LOWER TONNAGE IS JUSTIFIED

Edwin Ludlow, consulting engineer of New York City, was of the opinion that a lower production should be expected of coal loaders than of metal muckers. He stated that much of the coal in the Illinois region was cut a few inches above the bottom in order to avoid impurities which were found in the base of the bed. As a result, the miner had hard shoveling and not a smooth surface on which to work. For this reason, Mr. Ludlow said, the output was obtained with greater difficulty than would otherwise be the case.

He said that it should be remembered, when a tonnage of about four tons per man was figured, that it was based on the whole labor force of the mine and the whole tonnage resulting therefrom. Consequently the tonnage per man was a unit not of coal extraction or coal loading, but a unit of output, in which the

numerator is the whole output of the mine and the divisor the number of employees of every kind employed therein.

He stated that the real difficulty which confronted the coal industry was the large number of “officers,” or would-be “officers,” around the mining regions. The mining army was one which lacked persons who were willing to serve as “privates” and perform the actual labor at the coal face. This difficulty was growing, especially in view of the fact that so many of the men who had hitherto done the rough work at the face were now taking boat, or had already taken boat, to Europe.

DECLARES COAL MINING A SELECTIVE PROCESS

Edwin M. Chance stated that coal mining was in many ways different from the mining of ore of the type described by Mr. Thacher. He said that the mining of coal was largely a selective process, and in consequence it was necessary in many cases to employ a large number of men on the picking table, or to require the miner himself to make the most careful selection of the coal fit for market. There is considerable difference between the undercutting and careful shooting of coal followed by its careful preparation from a system in which the material is all shot down without any care and then loaded in bulk into the cars, the separation of the ore and gangue being regarded merely as a mill process.

R. V. Norris declared that low production per man arose to a certain extent from the number of farmer mines and high-cost mines of other descriptions. He stated that in every district there were five to fifteen per cent. of the operations which were of such a character that they should not be operating. These mines not only reduced the production per man but tended to decrease the record number of the days worked in the year, because such mines were operated by farmers and by men who only worked in the mines when high prices for coal were paid.

RICE DEFENDS LOW EUROPEAN COAL TONNAGES

George S. Rice declared that the figures which were given as averages of the regular days in the mines of any state were simply averages, as the word indeed implied. Many railroad mines and mines connected with steel mills worked much more steadily than “custom mines,” while those collieries that depended on trade in general were idle. Much of the hard feeling which had existed resulted from the fact that one mine might be working with a comparative degree of steadiness, while another one a mile or so away might find it extremely hard to get in one day or two days a week.

He declared that here in the United States we should not take too much credit to ourselves because our tonnage was so much larger per man. It must be remembered that in Europe the mines were of greater depth and had often extremely bad roofs. Furthermore, it must be remembered that in many countries it was practically obligatory to fill in the measure with hydraulic or other filling as fast as the coal was removed. Thus, he said, there was a double operation—the removal of the coal and its replacement with filling. He might also have said that there was a treble operation, because the filling itself has to be extracted in the first instance. He called attention to the fact that much of this filling material had to be carried quite a long way on the railroad. All these things, he said, prevented the European countries from getting out as

much coal per man as was obtained in the United States.

Mr. Hudson remarked that 40 per cent. of the operators were "economic mistakes" and should not be in the business of producing coal, because they had not the knowledge or the equipment to produce it cheaply. He stated that this 40 per cent produced about 20 per cent of the coal on the market and had a great deal to do with the fact that the mining of coal as an average was not as profitable as it ought to be. His remarks closed the first session of the conference on the stabilization of the coal-mining industry.

On the morning of Wednesday, with Edwin Ludlow presiding, Prof. H. H. Stock read an interesting paper on Coal Shortage with lantern slides to illustrate his subject. He quoted Abram S. Hewitt to show how irregular work at an early date made severe difficulties for the coal industry. Mr. Hewitt was president in 1876, but his presidential address seemed as true to today's conditions as to those he was describing at that distant date. He quoted the experience of the Commonwealth Edison Co., which had kept coal in continuous storage for 10 years without the coal once firing.

SHOULD WE VENTILATE COAL STORAGE PILES?

He spoke against the ventilation of coal piles unless the ventilation was made adequate to keep the air cool despite the rapidity of oxidation, which such aeration causes. He stated that Canada had been successful in providing such ventilation without evil result. Pipes were put at 4 ft. centers, instead of as far apart as was customary in United States storage piles. However, Mr. Stock added, Canada has the advantages of a colder climate, and the less torrid summer of that country did not subject the coal to so severe a firing test.

The cost of storage, he said, ran between 2½c. and \$1.50 a ton. These were, however, quite exceptional limits. With moderately good mechanical equipment the cost ran between 10c. and 50c. or 60c. per ton. These figures covered only the cost of labor and supplies. Depreciation of the equipment and coal, the spoiling of the coal by mixture with impurities scooped up with the stored material when the bottom was reached, and the cost of the use of the land on which the coal was stored were not included in any such storage charges. A common rule was to estimate 10c. for putting coal into storage and 10c. for taking it out, but the increased cost of every form of service makes it necessary to revise these figures upward.

WATER WILL QUENCH FIRE IF IT PENETRATES

He stated that coal could readily be quenched with water, if only enough of it were used and if it were compelled to enter the coal piles and not allowed to run off without doing its work. Coal which heats gives off a tarry material which causes the fuel to be bound together in such a manner that the water sprinkled on it by sprays runs down on the outside of the heated area and drains onto the ground around without having performed its intended work.

Ralph Bradley, of the Boston & Maine R. R., said that New England always stored large quantities of coal, because it knew that it must store fuel or do without. The B. & M. uses 5,000 tons a day during the summer and 6,000 tons a day during the winter. It stores 400,000 tons of coal in the summer where richer roads that are near the mines have, instead of over two

months' supply, only enough for the needs of four or five days. It seemed unfair to him that during the month of November when the strike was going on, his road was allowed no coal at all because it was possessed of so large a stock on hand. There is no reward given to those who lay out their money if the infrugal are to be allowed, when trouble comes, to protect themselves by confiscation.

NEW ENGLAND AND NORTHWEST STABILIZE TRADE

There are, he added, two areas in the United States where preparation to meet the winter needs is provided. These areas are the Northeast (New England) and the Northwest. He advocated that the practice of having the individual coal user store his own coal was expensive both in the use of land and in the installation of storing equipment. He declared that the small consumer dumped coal from the hopper onto the ground and had it laboriously shoveled by hand into a motor truck wasting not only labor but also unnecessarily holding up the equipment of the railroad and of the consumer.

Hence he advocated the creation of central storage plants in control of producers, wholesalers and consumers, capable of storing, on expensive land, large quantities of coal and equipped so as to put the fuel into storage and remove it therefrom with a minimum of expense.

Mr. Bradley's experience convinced him that there was just as much risk of firing when the coal was stored under cover as when it was not provided with any protection. He informed his hearers that he had stored the coal from the Clinch Valley for several months, in piles 30 ft. high, and had never had the least trouble.

ROADMASTER, NOT KNOWING BETTER, IS TO BLAME

Eugene McAuliffe said that his experience had been that when a president of a railroad decided to store coal against a shortage, he gave orders which passed rapidly down the line and the road master or wrecking master finally found the matter left wholly in his hands and piled the coal so that its dumping and reclaiming would give him a minimum of trouble. No care was taken to prevent the spontaneous ignition of the material, for the worthies who stored it had never made that subject a matter of a moment's consideration.

He declared that though there was a certain loss in storage from theft he never failed to get more cars of fuel out of the pile than he put in, because so much soil was mingled with the coal. This remark was given utterance, because Mr. Stock had stated that in one case the coal instead of being laid on prepared land was actually dumped on the rough surface of a plowed field.

In relation to the notion that the proper place to store coal was at the mines he stated that he was manager of a mine in Illinois (Kathleen), and that last week his men had only 17½ hr. work, owing to the defective car supply. "How," said he, "would my mine workers like to divide up cars with a storage pile that had been accumulated in the summer? Surely," he said "they would want all the cars they could get to make the conditions under which they labored bearable."

S. L. Yerkes' paper followed. The reader will not be satisfied to receive it in inadequate synopsis. He will want it in full and it will be so published. Mr. Yerkes

said that it was a commentary on conditions that at one time there were 250,000 cars idle and in 8 months that condition had been changed to one where there was a shortage of 75,000 cars. According to A. Gutheim, who spoke shortly thereafter, the first period was in February and March and the second in August. Mr. Yerkes said that 20,000 locomotives were needed and 600,000 freight cars.

H. M. Chance declared that he did not see how an increased car supply, a larger locomotive equipment or better service in the transportation department would rectify a fundamentally unsound condition in the coal industry. There were too many mines with too large a capacity manned by too many men. Even if the transportation difficulties were all solved there was not in the market demand and place for such a large tonnage of coal as the mines could readily produce. A. Gutheim of the Central Coal Committee made a long extempore address, which if specious was nevertheless interesting and illuminating. He showed that it was necessary to give the railroads the assigned car privilege, or else, what was less desirable, the right to confiscate, for that was the only way for the railroads to get coal during a period of coal shortage. When the turmoil of a coal shortage harassed an unhappy country, only by assigning coal to be loaded for specific purposes could the railroad and other public utilities be assured of getting fuel of the quantity and quality desired.

All of which is well and good, but why should a nation be pushed to such straits that it must take these high-handed methods of procuring coal when through the greater part of the year the mine operators are clamoring for orders and the mine workers restlessly waiting for an opportunity to work? The railroads and the utilities should not allow themselves to be faced with a contingency which makes it necessary to lay aside those righteous laws by which in the happier past our country was governed.

He admitted that on some roads, as Mr. Yerkes had stated, there were no cars obtainable but "assigned" cars. The consumer who had made contracts with the mine owners had no rights that the utilities were obliged to respect. He declared that when confiscation was resorted to, the cars had practically to be taken from the front end of the train; the draft was therefore neither uniform nor equitable. Sometimes the most needy consumers failed to receive their supply; sometimes high-grade coal was used for low-grade uses. The assigned-car system was the better plan. Perhaps that is so; between one form of unrighteous act and another there may be a degree of difference, but all are alike improper, and Mr. Gutheim, faced with a condition of the railroad's own making, urged the right of the railroad to take the necessary means to meet the situation. Thus may the farmer who has no wheat because he has failed to plant justify himself in an invasion of his neighbor's granary.

Mr. Gutheim declared that before 1917 sporadic short-

ages of cars, which were of short duration, occasionally occurred. They were largely due, in his opinion, to the slow movement of cars that naturally resulted from the rigors of severe winters, rather than to any real lack of equipment on the part of the railroads.

C. Andrade, Jr., treasurer of the Matlack Coal & Iron Corporation, declared that the coal-export business would stabilize the coal trade. He urged that storage of coal would mean the tying up of large quantities of capital and that would be uneconomical. A rapid turnover was what was wanted. He said that coal would have been stored in quantity had the practice been economically sound.

In opposition to what Mr. Andrade stated, it may be said that unfortunately the loss from idle men is greater than the loss from idle capital, and furthermore if the coal mines are to be equipped to meet in a few months the needs of the whole year there will be a greater economic loss than would result from a liberal amount of storage. Mr. Andrade well said that unless Europe gets coal to set her factories in operation, exchange cannot be brought up to par value, and the present crisis in Europe cannot be mended.

Mr. McAuliffe said that the practice he had followed in buying coal for the railroad had been, not to contract to purchase of any one firm any more coal than

it could supply at times when the car supply is at a minimum. In this way he had avoided much friction and had made a more general disposition of orders.

In the afternoon session, Eugene McAuliffe read his paper on the "Stabilizing of the Market," in which he presented the advantages of freight-rate differentials. He stated that at some of the small coal mines, worked during the stress of the war, the coal delivered to the cars contained as much as 50 per cent ash. The methods of loading were such that some cars were held 12 days before their loading was completed.

It was brought out, if not by him, by some one else who was present, that car shortage resulted in high prices, and high prices in the entrance of the high-cost mines with poor facilities into the business. These mines by their inefficient arrangements made the car shortage greater and did not better the situation at all. As soon as the stringency ended the high-cost mines closed down. Thus the railroads from having inadequate equipment came suddenly into a period when cars were idle.

He remarked that just before the strike one mine lost 25.6 per cent. of the time of its men owing to absenteeism. Yet these men faced a long shut down. It is impossible, he said, to get the men to work regularly. Speaking about the high cost of coal, he said that jobbers with a "shoestring" capital spring up whenever there is a coal shortage and go around peddling coal. He had himself signed vouchers to such gentry of \$1 per ton delivered. The coal industry needed relief from men of this kind.

(To be concluded.)

Railroad stagnation rapidly changes to a severe railroad shortage. Yerkes advocates larger equipment, but Chance declares trouble is more immediate and fundamental—an excess of both men and mines in the coal industry. Gutheim defends commandeering and assigning of railroad cars, while Andrade says storage of coal is generally economically unsound or it, surely, would be more general. McAuliffe covers many industrial ills in presenting his freight-rate differential plan.

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Sulphur Percentage and Fuel Ratios

IT WILL be a surprise to many to learn that the fuel ratios vary quite largely in the coals of the State of Illinois, that the result of dividing fixed-carbon content by volatile-matter content is about 1.5 in Jackson County and only about 1.0 in the Rock Island and Mercer coal field and that the thermal units in Jackson County are 12,488 on the British, or Fahrenheit, standard and only 10,514 in the Springfield-Peoria district, Bed No. 5.

It must be remembered that Illinois though level for the most part is not by any means a State which has not had its period of catclysms. In the Saline field may be found dykes, faults of 160 ft. throw, and dislocations of less dimension and in the La Salle field tiltings around 45 deg. By no means has all been peaceable and orderly. So much is covered by horizontal measures of later date, glacial drift among other, that it is hard to believe that there was a time when Illinois had severe earthquakes, faulting and lava flows, small of course but existent nevertheless. Such disturbances might explain the variation in the "greenness" of the coal. Some coals apparently have been artificially "aged," and some have merely matured without being toasted by heat.

An interesting table has been calculated from a diagrammatic tabulation contained in "Coal Resources of District V" by Gilbert H. Cady in the well-known series of "Illinois Mining Investigations," the analyses being taken from some 313 tests made by J. M. Lindgren. The figures show, or seem to show, like the figures which investigation develops in the more Eastern States, that there is a relation existing between sulphur content and fuel ratio, the sulphur declining as the fuel ratio increases. The table follows:

Region	Seam No.	Sulphur	Fuel Ratio	B.t.u.	Moisture
Jackson County.....	2	1.29	1.5015	12,488	9.28
Williamson & Franklin.....	6	1.53	1.4141	11,825	9.21
Saline County.....	5	2.92	1.3728	12,276	6.75
Danville.....	6	2.55	1.1240	10,919	14.45
Rock Island and Mercer.....	1	3.59	1.0416	11,036	13.46
S. W. Illinois, W. of Duquoin....	6	4.01	1.0265	10,847	1.56
Springfield-Peoria.....	5	3.52	1.0217	10,514	15.10
Danville.....	7	2.93	1.0120	11,143	12.99
La Salle or Longwall.....	2	2.89	0.9758	10,981	16.18

The fields are arranged in the order of decreasing fuel ratio, and it will be observed that the sulphur can only be said to increase, in general, with the decrease in that ratio. One hesitates to deduce from such a showing that the ripening of the coal reduces the sulphur content, for look at the Danville No. 7 and the La Salle coals, but remembering that different seams are likely to have different originating flora and therefore different sulphur percentages and that the sulphur content varies from place to place with the same seam, the figures are quite suggestive and add their little mite to the generous confirmation shown in other States. Low sulphur and low volatile tend to occur in the same analysis. Has not anthracite, the lowest volatile constituents and is it not remarkably free from sulphur?

The facts seem to suggest that heat readily drives off that part of the sulphur which is in organic form or that, in ageing, the organic compounds break up and secondary sulphur compounds are liberated. Especially does it appear that this action is more marked when the maturing is rapid than when it is slow.

The organic sulphur may in part be extremely stable but indications are that some of it is not any too strongly held. The action of the loosely combined sulphur is worthy of study as it may be a cause of spontaneous combustion through combination with iron aided by the heat of dissociation from the combinations in which it is found. The study of organic sulphur in coal is still in its infancy and it will be a fruitful field for the investigator for years to come.

Did the Stabilization Conference Settle Anything?

SO MANY branches of a difficult subject were taken up by the conference on the Stabilization of the Coal Industry that it could not be expected to arrive at the basis of any of them. The only enlightening suggestion was one associated in the public mind with Mr. McAuliffe and that suggestion is not exactly new. Differential freight rates were advocated in *Coal Age* on Dec. 2, 1916, in an editorial entitled "Do Your Christmas Shopping Early," and this admonition was made the subject of some remarks by the same author at a meeting of the Coal Mining Institute of America in the same winter.

To quote the editorial: "The railroads themselves should help to smooth the seasonal irregularities. Why, when freight rates are raised, which is sure to happen soon, could not they arrange to put all that increase on the winter service? The railroads would surely gain immensely by regularity of operation, which would enable them to keep their equipment in continued profitable operation and their employees steadily at work. It would also increase their traffic at the one period of the year, when it is conducted at least cost and with least loss."

At a recent conference of the public utilities which use the public streets for their services comes the statement that storage does not pay, that the companies could store more if an inducement were afforded. It may well be conceded that storage must be made to pay if it is to be practiced extensively, and in such measure as to steady the industry, but there seems such a determination to keep coal prices and freight rates down in the winter to a level that will give a bare subsistence that there seems no hope of putting summer rates any lower. Winter rates must be made sufficiently generous as to permit of their safe reduction in the summer. This is true whether the coal industry or the railroads furnish the required differential.

Coal operators cannot be expected to run approximately nine months at either a loss or without a profit, and then be allowed to make only a 6 per cent. per annum return for the short space of three months, which would be an average of only 1½ per cent per annum, even if the summer trade were conducted without profit or loss.

Public utilities may be, and in fact are, near bankruptcy, but their necessities should not be cured by oppression of other utilities any more than of the laboring men who serve them. Their correct means of redress is by fair rates. They will gain nothing by blackening the fair reputation of the coal producer or the railroads, which

are victims with them of a perverted public sentiment. Recriminations between the servitors of the people will only result in the public having a contempt for all alike and an exalted opinion of those who conduct their business without recrimination, but with great profit—to wit, the non-utility classes of industry.

Dangers of Regulatory Bodies

AT THE meeting of the American Institute of Mining and Metallurgical Engineers, George S. Rice proposed that some syndicate method of providing for the doing away of cut-throat competition—which made the conservation and other important provisions impossible—be adopted and that a commission be appointed to regulate prices in the interests of the public and to prevent the opening of mines which were not needed for the current consumption. He declared that in his belief such a commission would be as fair as was the Fuel Administration after the first few months of its existence.

It is true that this Administration during much of the war was fair to the bituminous coal industry but, by its own admission, it was not fair to the anthracite operators, and it cannot be said that its decision regarding the strike was equitable and such as to make any coal operators anxious to revive in peace its war-time activities. It is a fact that every regulative body starts in with a fairly good record. Prices are high when it starts its operation; that is why it is called into being. The Fuel Administration had it arrived a little earlier and established the Pea-body-Lane scale of prices would have been hailed as a deliverer, and yet the profits of the coal men would have been quite a little better than merely satisfactory. But after the prices are fixed, trouble quite usually begins. The regulatory body feels it would be quite a shock to the public if it made any increase in prices owing to increased wage or material costs, or to additional expense due either to changed working conditions or to new regulations made for the purpose of securing conservation, safety or health.

As a result the regulatory board becomes readily a repressive body. Pressed by the public it fears to make an unpopular decision. It seeks to excuse itself by imagining that a profit can be made in the business should

there be sufficient business activity to reduce overhead, and, if a loss results or there is a failure to duly profit, then the hope is that the times were so abnormal that no unfavorable deductions may fitly be drawn from that highly inconvenient fact.

That most benignant of bodies, the Federal Trade Commission of the Hurley days, did not have regulation but investigation as its aim. It did not have the same occasion as the Interstate Commerce Commission, the Fuel Administration and local public-service commissions to become inimical to honorable business endeavor but nevertheless it took the same course, which shows that there is a dual influence at work—a desire to keep down the cost of living, no matter at what price and a general disposition to demand the profitless operation of all utilities.

With a commission having its life extended through the years, there is always a risk that it will reach a time when unfair influences prevail, and then we shall hear the cry, as we have with the railroads, that there is such a great difference already created between present rates and fair profits that it is obvious that the needed rectification of rates cannot be made without injury to the public welfare. Just now comes an opportunity to an old established regulatory body to support the reputation of all such institutions by just and considerate action. The Interstate Commerce Commission has laid on it the work of fixing freight rates for the railroads on such a level as will make it possible for them to do business and make a 6 per cent return. Will they do it or will they flounder with half measures as has Mr. Hines in his conduct of the Railroad Administration? Herbert C.

Hoover well said that any excessive generosity to the railroads might create a revulsion in favor of Government ownership in some new form. But there are intermediate measures that can well be taken. The railroads have been well spanked and put to bed for the Hamilton and Dayton and like offenses, so there is no advantage in spoiling the meals of the railroads by serving up such unpleasant recollections whenever they sit to meat.

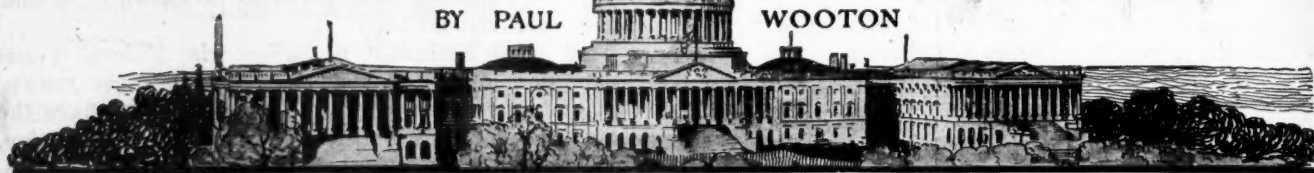
Let the Interstate Commerce Commission, if it makes a mistake, make it in the direction of too high a rate instead of one too low. As the returns to the railroads are limited, there will be no loss to the public, and the screws may be brought down later if the public desires.



NEWS FROM THE CAPITOL

BY PAUL

WOOTON



Senate Orders Hines To Make Complete Report of Coal Stewardship

In the Senate of the United States, on Feb. 10, Mr. Frelinghuysen submitted a resolution; which was considered and agreed to and reads in part as follows:

Resolved, That the Director-General of Railroads is hereby directed to report to the Senate as soon as practicable:

The extent of the authority, powers, and duties with respect to the shipment, distribution, apportionment, or storage of coal or coke, which were originally delegated to the Fuel Administration under an act entitled "An act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of food products and fuel."

The exercise by the Director-General of Railroads at the present time of the powers so delegated and the extent.

The exact contents of all papers, documents, or memoranda delegating or conferring authority, powers, or duties upon the Director-General of Railroads with respect to the shipment, distribution, apportionment, or storage of coal or coke.

Federal Trade Commission's Report on Illinois Field

Some of the points of particular interest in the Federal Trade Commission's report on the cost of producing coal in Illinois are as follows:

(1) The situation in the bituminous-coal industry in Illinois during 1917-1918 bore a much closer resemblance to that in the Pennsylvania anthracite industry than to that in the Pennsylvania bituminous industry. In Illinois, as in the case of Pennsylvania anthracite, the increases in sales realizations were more nearly proportionate to the increases in costs.

(2) In general, in the different Illinois districts, there was not such a wide difference between the margins prior to the period of Governmental price-fixing and those subsequent thereto. This is in striking contrast to the reduction of the margin in the case of the Pennsylvania bituminous-coal industry, particularly, in the southwestern field, which took place subsequent to August, 1917, when the Governmental price regulation went into effect.

(3) Wide differences in conditions are shown to have existed between some of the Illinois districts. For example, for District 1, in the northern part of the state, where 76 per cent of the output came from mines which produced pick-mined coal only, there was a relatively high labor cost per ton. For District 6, in the southern part of the state, where only 14 per cent of the output was pick-mined coal, and over half of the output was

machine-mined coal, there was a relatively low labor cost per ton, as pointed out in the report.

Such differences in conditions involve differences between the districts in the amount of the margin necessary to equally profitable operation. In the one case the investment in mining machinery was relatively small, since the coal was mined chiefly by the direct application of hand labor, resulting in a relatively high labor cost per ton. In the other case, where the coal was mined, chiefly with machines, the labor cost per ton was relatively low. But there was a relatively heavy investment in mining machinery. The margin (i.e., the difference between the sales realization and the f.o.b. mine cost) necessary to a profitable operation should be large enough to include a suitable return on the investment; and in the latter case must provide for a return on the investment, and must provide for a return on the additional investment in labor-saving machinery.

(4) The report presents in detail many figures showing the proportion which the labor cost formed to the total f.o.b. mine cost (exclusive of any return to the capital invested) and the proportion which such labor costs formed of the amount received from the sale of the coal. Thus, in 1918, the labor cost in the different districts was from 75 to 80 per cent of the total f.o.b. mine cost, and was from 61 to 71 per cent of the sales realization."

Ruling on Paying Railroad Claims

Below is a copy of a letter which General Counsel Underwood of the U. S. Railroad Administration has issued to all Regional Directors under date of Jan. 16, 1920, and having to do with the payment of claims on account of shipments moving prior to, and during, Federal control:

"The Interstate Commerce Commission has held in the Decker Case, I. C. C. Docket 10,696, that it does not construe the limitation in the bill of lading as prohibiting the payment after two years and one day of meritorious claims if reasonably filed.

"Claims on account of shipments moving prior to Federal control, if filed within the period prescribed in the bill of lading, should be paid or declined on their merits, notwithstanding the two years and one day clause in the bill of lading, provided that in every case, the consent of the corporation to such payment is first obtained.

"Until further notice, claims on account of shipments moving during Federal control, if filed within the period prescribed in the bill of lading, should be adjusted on their merits, notwithstanding the two year and one day clause in the bill of lading.

"Extreme care should be exercised in the settling of all claims of this class so that there will be no discrimination."



DISCUSSION *by* READERS

EDITED BY JAMES T. BEARD

Authority of Shotfirers

Letter No. 3—That is an interesting question raised by a shotfirer of Nortonville, Ky., and which appeared in *Coal Age*, Jan. 3, p. 26, regarding a dispute that arose between the miners and the shotfirers employed by the Norton Coal Company of that place. It seems that the miners wanted the shotfirers to open the ends of the sticks of powder when charging and tamping a hole, claiming that if this was not done the explosion of all of the two or more sticks charged in the same hole was not certain.

On the other hand, the shotfirers refused to fire shots prepared in this manner, claiming that there was danger of the loose powder being ignited by a spark caused by the tamping bar coming in contact with a sulphur ball in the hole, even when using a copper-tipped tamping bar.

The question might be properly asked, Who employs the shotfirers and who pays them, the company or the men; and who will assume the responsibility for their being killed? It is evident that black powder was used in this case, but no mention is made as to whether the coal was undermined or shot off the solid.

WHAT THE MINING LAW REQUIRES IN BLASTING

However, setting these questions aside, the fact that there are numerous methods in use for charging and blasting coal, and many accidents occur daily from the careless handling of powder and holes being improperly drilled, charged and tamped, has made it necessary to restrict, by law, the work of shooting coal in mines. In many states the law requires the employment of competent shotfirers and clothes them with authority to refuse to fire any shots that, in their judgment, are unsafe.

My opinion, in this instance, is that where a hole is charged with two or more sticks of powder, the sticks should not be opened but pushed carefully back into the hole with a wooden tamping bar. As each stick is pushed into the hole and forced home, the needle can be used to prick a small hole in the end of the stick. If this is done there will be no danger but that the entire charge will be exploded at one and the same time. Where fuse is used the charge should be made up in a single stick and tamped with a wooden bar after inserting a cart-ridge or plug of dry clay.

STATUS OF THE MINE COMMITTEE

The work of shotfiring is dangerous at the best and a shotfirer takes his own chances if he fires a shot that he sees is improperly prepared. While a mine committee always has the right to ask the reason why a shotfirer refused to fire a shot, it has no authority to go further and demand that he shoot the hole. Should the committee decide that the shotfirer has deliberately turned down and refused to fire a shot that they consider safe, all they can do is to ask that the miner be

recompensed for the loss of his day's work. The disputed question can only be decided, in that case, by the state mine inspector.

Shotfirers are supposed to know the law and to realize the responsibility resting on them by reason of their position, and no person has any right to question their decision in refusing to fire a shot considered to be unsafe, inasmuch as the shotfirer is employed in the interest of his own safety and the security of the mine.

Let me add in closing, that the use of black powder loose in the hole cannot be recommended, under any condition in shooting coal. Further, a charge of black powder should not exceed two feet in length, in a hole 2½ in. in diameter. When a charge of black powder exceeds 35 per cent of the length of the hole there is danger that the shot will blow its tamping, and my experience is that these limits should not be exceeded.

Farr, Colo.

ROBERT A. MARSHALL.

Lawful Examination of a Mine

Letter No. 10—At a recent meeting of superintendents, mine foremen, firebosses and others closely related to mine operations, there was organized the "Upper Potomac Mining Institute" of West Virginia, for the purpose of reading appropriate papers and discussing subjects pertaining to mining. The institute is to meet once a month, and the aim will be to discuss points that are not clear and to draw out the unbiased opinions of the members.

There is little doubt but that such meetings will be of exceptional interest along practical, safety and social lines, and that not only the members but all the workers will be materially benefited. In this connection, let me remark that I do not know of a subject that could arouse more interest than this one, or that is of greater importance and more direct benefit to the men engaged in and around the different plants. Indeed, I feel that, after these meetings have been a reality for a few months, there will be a more careful analysis of the methods now used by those making the examinations in our mines, and that more efficient and safe means will be employed.

SYSTEM NEEDED IN EXAMINING A MINE

I note with pleasure that many of the letters that have appeared in *Coal Age* advocate the three-hour system of examination, as specified in our state mining law. But it has been my contention, for some time past, that a more systematic procedure of examination is necessary in order to have a thoroughly practical and safe mine organization.

In my opinion, a mine should be divided into sections. The opening and ventilation of every mine should involve that consideration at the start. Each section should be of such size that an assistant foreman could have complete supervision of its working places in each shift. At a large mine, all section foremen should meet

two hours before starting time, enter the mine at the same time, and again gather on the outside to compare notes of their examinations, before permitting the men to enter the mine. They would then make out their reports, consult with the mine foremen and return to their respective sections, until one hour before the miners quit work.

As a rule, miners do not work to within about an hour of quitting time, and this plan would not keep the assistant foreman away from his men but a short period. He should remain where he will be in close touch with his men and be able to help them in every way possible. In a large mine a night foreman may be necessary, but his presence is not as needful as on the day shift, although the same process of examination should be effective during the night as in the day.

SYSTEMATIC EXAMINATIONS WILL REDUCE ACCIDENTS

A system of this kind with efficient foremen and assistant foremen should reduce the number of accidents one-fourth to one-half. And in time, as the foremen and men entered more spiritedly and honestly into their work, accidents would be a thing of the past.

A mine would then have what I would call a "lawful examination." More practical methods and ideas would come into use. The mining laws and mine regulations would be more strictly obeyed and all workers would exercise greater care. A closer co-operation between men and officials would result. And the slogan "Safety First" would be recognized and more faithfully practiced. With this system working smoothly there would be less chance for accidents to happen, and time and money lost by the men in the past would begin to show on the credit side of their accounts.

A truly friendly atmosphere would surround such a community and the spirit of good fellowship be everywhere in evidence. Let us hope for these results.

Thomas, W. Va.

BEN.

Letter No. 11—This subject and that of "Finding a Mine Door Set Open," the discussion of which has just closed in *Coal Age*, are closely associated. The letters presented contain many good suggestions that cannot fail to benefit all who have followed these discussions closely, from week to week.

The experience and judgment of practical mining men make them agree that it would be far better if there were no doors to be left open in a mine. However, all men are human, and we know it is a common thing to find an open door. The door may have been broken by a derailed car and not reported, through neglect, in which case the fireboss will find it open when making his rounds in the morning.

WHAT IS A "LAWFUL EXAMINATION" OF A MINE?

In order to make a *lawful* examination of a mine, the fireboss or mine examiner must comply with every requirement of the mining law. In Illinois, the law requires him to see that the air current is traveling in its proper course and that the quantity of air in circulation is sufficient.

The law specifies an air volume of 100 cu. ft. per man per minute, or 150 cu. ft. if the mine is generating gas, and 500 cu. ft. for each animal employed in the mine, but the mine inspector is authorized to increase this quantity according to his judgment. The law also requires the examiner to measure the air in the last cross-cut of each pair of entries, using his anemometer for

that purpose and recording the quantity of air measured in a book kept for that purpose. He must examine all places where men are required to work or to pass, and to observe any dangerous condition of roof or accumulation of gas.

Now, in the performance of these duties, the examiner will often be compelled, in actual practice, to do some things he should not do, or act in ways that he would not choose to follow under other conditions. For example, the section of the mine in his charge may chance to have two or more air splits; and the examiner in following up one of these splits, proceeds with the air. Then, to save walking back to the mouth of the second split, he may take a short cut and start to examine the next split, proceeding against the air.

This is a practical condition and one that cannot be avoided if the examiner is to save time and report back to the shaft bottom in time for the men to enter the mine for work. Other instances could be mentioned in which practical conditions control the manner in which the examiner must proceed; but in all cases his examination of the mine must comply with the law or it will not be a lawful examination.

Staunton, Ill.

WILLIAM M. CHAMBERS.

Avoidable Degradation of Coal

Letter No. 2—While I support heartily every effort made to produce cleaner coal and a larger percentage of lump, and am fully aware of the difficulties in the attainment of this object, and realize the importance of this matter in respect to marketing the coal, I feel at the same time that we are prone to overlook certain underlying factors that must be considered in determining the miners' just responsibility for the loading of inferior coal, which has long been a trying problem in the industry.

In his letter, *Coal Age*, Oct. 2, p. 586, Richard Bowen has discussed the question so ably that it would seem little remains to be said along the lines he has mentioned; namely, the need of modern machinery for the conveying, washing and sizing of the coal, and the advantage to be gained by adopting a suitable plan of mine and employing methods of working that will reduce the breakage of the coal in the mining and transportation of the product from the face to the tippie.

EFFECT OF THE "CONTRACT SYSTEM" IN THE LOADING OF DIRTY COAL

Mr. Bowen further urges that "more attention should be given the miner, who must be taught to use more judgment and skill in the performance of his work." This is certainly true in that it induces the miner to take a deeper interest in his work and gives a greater degree of safety.

Observation and experience convince me, however, that one vital factor affecting the problem is the contract system of wage payment, under which the miner's earnings depend on the *quantity* of coal he mines. While the contract system is fair and honorable in that it establishes a just basis of payment and promotes smooth relations between the miner and his employer, it cannot be denied that the system possesses one unfortunate feature, which is indirectly responsible for the loading of much dirty and inferior coal.

Realizing that his wages are in direct proportion to the amount of coal he can load, the average miner is

possessed with the one desire to increase his output. As a result, he is not always as particular regarding the *quality* of the coal he loads, as he is in respect to the *quantity*.

Now, whatever measures may be taken to produce cleaner coal and a larger percentage of lump, must have a restraining effect on the earning capacity of the miner, under the contract system. It tends to decrease his output, reduce his wages and incidentally increase the cost of production. These, I say, are matters to be considered in determining the miner's responsibility for the degradation of coal.

In respect to improving the quality of the coal produced, the suggestion of teaching the miner to use "more judgment and skill" in blasting his coal, seems to be an idle one, when their interests are made to depend on the *quantity* of their output. Experienced miners will generally question any suggestion that judgment and skill are wanting on their part, while they are using these factors to the extent of their ability to increase their earnings.

Since the miner must purchase the explosive to blast his coal, it is foolish to think that he is not using his best judgment and skill in placing the shots in a manner that will reap the largest harvest. I am not excusing careless, indifferent and incompetent miners, who regard lightly the degradation of coal, and use excessive charges of powder to break it down. Such men must be weeded out and taught better methods of mining.

STUDYING THE QUESTION IN THE LIGHT OF ITS PRACTICAL ASPECTS

The point I would emphasize, however, is that the question of the degradation of coal, as it concerns the miner, must be studied in the light of the conditions that affect his work at the face. It is my belief that the average miner realizes that it is as much to his interest to keep the mine running regularly, as it is to the interests of the company. Also, that the steady operation of the mine depends on the *quality* as well as the *quantity* of the coal produced. It is a broad question and one that requires careful analysis, in determining its right solution.

There is much food for reflection in the concise remarks of a miner who, in speaking of the quantity of dirty and inferior coal sent out of the mine, agreed that it was possible for the miner both to load cleaner coal and obtain a larger percentage of lump. But, in doing this, he claimed that "complications would arise between the miner and the company that would not be for the interests of either party." He argued that both would suffer from a reduced output and an increased cost of production, which would tend to lower the miner's wages or increase the selling price of the coal on the market.

The tendency of the times today is toward co-operation and profit-sharing between operators and workmen, in most all industries. Men prominent in financial and labor circles regard such schemes as means to secure more efficient and profitable operation and believe they point the way to industrial reform. It is generally agreed that the adoption of such schemes would lead to a better understanding between employers and employees, whose interests would become more closely identified with each other, and enable workers to take a broader view of industrial relations and comprehend their own responsibility for the business.

In closing, let me say it is in this direction that the most favorable solution of the question of the degradation of coal can be sought. However, in respect to the *quality* of the coal produced and the miner's responsibility for the same, it cannot be overlooked that the unhealthy competition existing among miners working under the contract system, and the ever-prevailing competition between different coal operations are chief factors in the problem.

WILLIAM WESNEDGE.

Ladysmith, B. C., Canada.

Promotion of Ambitious Workers

Letter No. 8—The discussion of this subject has interested me deeply. Like other questions of the kind, there are two sides to the question of promotion. Some writers seem to think that all a writer must do is to go ahead and do his best, and sooner or later his reward will come. This is no doubt true as an ideal condition; but, in practice, the deserving one is often robbed of a just return for the efforts he has put forth.

How often have we seen a good man set aside because the "old man" did not fancy him for some reason; or because the boss had a friend for the place. The friend's capabilities may ill fit him for the position, but that counts little with the big boss. I have known instances where the preference for a friend has cost the company thousands of dollars.

It would seem that some companies rather expect that a new manager or superintendent will make many changes in the official capacities of the men under them. The old bosses who have long been acquainted with the particular conditions in the mines are frequently fired to make room for friends of the new man. I have even seen it appear, for a time, that the change made was for the better; but this was generally due to the fact that the new foreman was reaping the benefit of the practical foresight of his predecessor in office, and the real truth only became known later as the output would fall off and the expense of operation increased daily. These are facts that no practical man can deny. Unfortunately, it is part of the mining game, much as we regret to admit the fact.

AMBITION AND THE WILLING WORKER

I like the way that the matter has been put in the letter of W. H. Luxton, *Coal Age*, Jan. 22, p. 195. Mr. Luxton urges the ambitious worker to "look on the bright side and one's chances of success will be greatly improved." As he has truly stated, it is discouraging to the ambitious worker to see things done in the manner I have mentioned. However, my advice to any young man, in the mining game, is, Do your best and never give up; but show the man under whose orders you work that you have ambition to do the work that comes, in the best manner possible.

If you are sent to the bottom of the second-left entry to clean out a ditch, go to it with a will. The smearing of your hands and clothes is far better than the danger of compromising yourself by showing a disliking for the work in hand. Remember the cleaning of the ditch is as important to the boss as any other work and he will wish it done right. If the boss is the right kind and, thank God, there are many of them, he will regard highly a man's willingness to perform any work given him and do it well. He has his eye on such men for higher positions when the opportunity offers.

It may be well when a man desires a certain place to make his ambition known to his boss; but, having done this, one must let the matter rest there. Should the boss later fill the place by appointing another man, rest assured that there is some good reason for what he does. Do not let that discourage your ambition. Be sure that fitness and capability for performing the work in hand will tell in time and in the end you will reach the place for which you are best fitted.

Not long ago, I overheard the remark of a man who said, "You cannot keep a good man down; he's bound to rise." Sometimes a little pull is a good thing, but my advice is that the ambitious man should not depend on "pull," but get busy and use a self-starter. Discouragement may come once or twice; but, some time, some where, you will find your niche and get your reward.

McIntyre, Pa.

THOMAS HOGARTH.

Letter No. 9—This is a question that naturally excites much comment among ambitious mine workers, when a vacancy occurs in some higher position, in the course of the operation of a mine. After the appointment is made, frequent expressions of opinion are heard regarding the wisdom and judgment displayed in filling the position. It is common to hear much adverse criticism.

Instead of emphasizing the strong points of the person appointed to fill the place, the too common practice is to dwell on those points in which the person may be deficient. It can be said with some degree of assurance that these defects are later found to be purely imaginary.

QUALIFICATION AND FITNESS CHIEF FACTORS

To my mind, the most significant factor to be considered in the advancement of an ambitious worker is his qualification or fitness for the office. The question is, Are his qualifications such as to make for real progress in the service of the industry? Personal interest may prompt one to discuss this question in the light of his own experience, whether or not he has realized his expectations.

Another will argue from the standpoint of justice to an ambitious worker who is thought to be better fitted for the place than the one selected. At times, influence or some other characteristic will be the controlling feature of the argument. In all such personal allusions, however, it is evident that the ambition is wrongly directed, in that the merits essential to promotion are overlooked.

SUCCESS VS. DISAPPOINTMENT AND FAILURE

It is one thing to gain promotion, but quite another matter to make a success in a new position, the ambition to reach which has been accompanied by hard work and painstaking effort to overcome the difficulties that beset the way. Large numbers of workers have had their ambition crushed and their ardor dampened by force of circumstances that are beyond their control. Too frequently the desire to excel is practically destroyed by the discouragements and influences that have retarded the progress of the ambitious one. For this reason, words of counsel and encouragement are helpful to all whose aspirations are to fill higher positions than those they already occupy.

There are everywhere disappointments and failures arising from the unfitness of one who has attained a

higher position through influence or by reason of some circumstance or fortune, and the advancement of such a one proves a burden. Again, the exaltation of the workman may subject him to worry through the manifest jealousies of his associates of less marked abilities than his own.

DIFFICULTIES ARISING FROM PROMOTION

Only recently my attention was drawn to the case of a man who had reached the highest position in his particular circle, through diligence and efficient service. His ideals were lofty and his generosity knew no bounds. Success attended his every effort and, for a time, he commanded the respect of his associates. But the cancer of envy and malice grew, in a certain field among his fellow workers, and eventually destroyed all that his ambition had created. Impaired health, through worry, forced this man to resign and shortly afterward he died leaving his family in want and poverty.

The incident shows how a man may sacrifice his all on the altar of ambition. The ancient writer Lucretius, in commenting on the vanity of human ambition, remarked, "Though men try to reach the highest honors, they often render the course of their steps full of trouble and, though they attain their object, envy like a thunderbolt hurls them in time from their pre-eminence and flings them with scorn into the gloom of Tartarus."

I may be wrong, but my observation inclines me to think that a stranger, or some person from a different rank of life than the worker, is more frequently respected when promoted to a higher position in the company, than is the case with one taken from the rank and file. Such resentment on the part of one's former fellow-workers is peculiar. It may be due to the exercise of caution in regard to intimacies and familiarities that prevailed formerly, but are now under restraint. However this may be, it should not destroy the ambition of an honest worker to excel and rise in his chosen calling. The man who would succeed must stand prepared to conquer every difficulty and breast every discouragement.

WILLIAM WESNEDGE.

Ladysmith, B. C., Canada.

Tamping Dynamite

Letter No. 2—Referring to the letter of Gaston F. Libiez, *Coal Age*, Jan. 29, p. 244, I fully agree with him that a charge of a low-percentage dynamite should be well tamped, while this may not be so necessary when using a high-grade explosive.

In blasting a vertical hole in rock, or a hole that dips at a sufficient angle, water is frequently used instead of solid tamping. In my opinion, however, it is little better than no tamping at all.

In my experience, all kinds of explosives give better results when some tamping is done. A detonating powder is quicker in its action, and permits of shortening stemming; but black powder, any grade, being slower should always be tamped tight to the mouth of the hole, in order to get the full effect of the explosion of the charge.

In the use of high explosives, it is quite true that the full efficiency of the explosive is not gained without some tamping is done; but care must then be exercised, as there is danger of exploding the charge if the tamping bar is used too forcibly in preparing the shot.

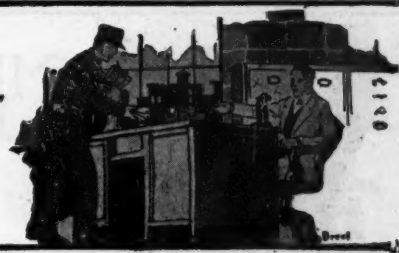
Rawdon, Quebec, Canada.

C. McMANIMAN.



INQUIRIES OF GENERAL INTEREST

ANSWERED BY JAMES T. BEARD



Carbide Lamps in Pillar Robbing

The work of robbing pillars was proceeding in an abandoned section of our mine when the generation of carbon dioxide increased to such an extent that oil lamps could not be used, and the miners were given carbide lights, which burned more freely in that atmosphere. I want to ask to what danger, if any, were the miners exposed, in the use of the carbide lamps?

Scranton, Pa.

MINE FOREMAN.

It is a well-known fact that the carbide lamp will continue to burn, though with somewhat diminished brightness and the flame taking on a reddish tint, in an atmosphere charged with carbon dioxide to such extent that the flame of an oil lamp is quickly extinguished. The presence of the carbon dioxide causes a corresponding depletion of the oxygen in the atmosphere. Careful experiments have shown that where the oxygen content of the air has been depleted by the addition of carbon dioxide, a fatal atmosphere is produced when the oxygen is reduced to 17 per cent, the fatality being due to the toxic effect of the carbon dioxide. At that point the atmosphere contains 17 per cent oxygen, 65 per cent nitrogen and 18 per cent carbon dioxide.

While this atmosphere is generally fatal to life, if breathed but a short time, it will support the burning of the carbide flame, which will give but a faint and frequently unobserved warning of the presence of danger to the men at work and breathing the air. A recently charged carbide lamp will continue to burn, in an atmosphere charged with carbon dioxide, till the oxygen content is reduced to 14 per cent or even less, which is far below the danger point in the support of life. Another danger to which the men are exposed is the possible presence of methane in dangerous quantity.

Working Kanawha River Coal

Having noticed that there have been answered in *Coal Age*, each week, many interesting problems presented by various readers, regarding their troubles, I take the liberty of presenting a proposition that we have had in contemplation for some time. It concerns the best method of attempting the extraction of the coal from three seams, which we understand underlie the Kanawha River bottom, in the territory surrounding Cedar Grove, W. Va., where we are now operating a small mine in a low seam of coal.

According to our information, the three seams mentioned lie at depths of, approximately, 50, 100, and 160 ft., respectively, below the river bottom. As reported by the drillers of gaswells, in the vicinity, the first two of these seams are believed to have an average thickness varying from 3 to 5 ft., while the thickness of the lowest seam mentioned is estimated as varying from 6 to 9 ft., with about 30 ft. of sandrock overlying the coal.

We are now preparing to put down three test holes, with a core drill, and if the results are favorable we want to study out the best and cheapest plan for the extraction of the coal. Without attempting to install too large and expensive equipment, we want to provide a plant that will maintain a daily output of 1,000 tons, in a working day of 8 hours. We contemplate sinking two shafts, 300 ft. apart, as required by law. These will be located at the foot of the mountain, convenient to the railroad and above the high-water level.

Knowing the high character that has marked the discussion of such problems as these by the practical readers of *Coal Age*, who have contributed generously from their own experiences in similar instances, we hope to receive much help and benefit.

Briefly stated, some of the more important considerations, in this case are: The order of extraction of the three seams mentioned, assuming that each of them contains workable coal of the average thickness named and of fair quality. I want to ask, Should the coal be taken from the upper thinner seams and these practically exhausted, before attempting the extraction in the lower seam; or should this order be reversed and the seam lying at the lowest depth be attacked first?

Again, should a shaft or slope opening be employed to give the most satisfactory results with a view to safety and economy of operation? The suggestion has been made of opening the first seam, which lies at a depth of 50 ft. below the railroad, by means of a slope equipped with some sort of conveyor for bringing the coal to the surface. On the other hand, a shaft opening has been advised sunk to the bottom seam and equipped with self-dumping cages or an automatic skip.

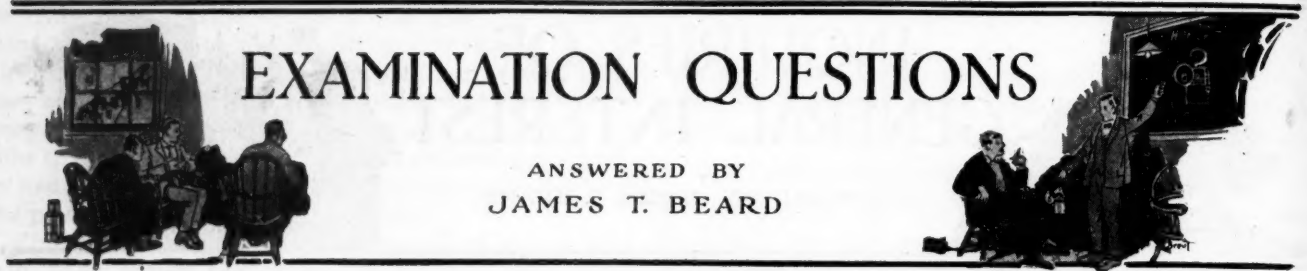
In connection with the slope opening, it has been suggested to weigh the coal on the slope bottom. One suggestion, in connection with the slope opening, was to build a concrete storage bin, at the bottom of the slope and having a capacity of 100 tons, and install a conveyor system that would take the coal from this bin and elevate it to the surface.

Lastly, we would much appreciate the suggestion of the best plan to adopt in the working of the coal in these seams. On the surface, the mountain rises to a height of 1,000 ft. above the railroad. The lower seam is probably that known as the "Eagle" seam, which is a gas coal and overlaid with a heavy rock top.

Charleston, W. Va.

ARTHUR L. SHELDON.

Coal Age gladly submits this proposition to its practical readers who are in every way fitted to give the best advice on the questions presented. Questions such as these relating to the economic and safe working of coal seams have always enlisted the deepest interest from men whose experiences have furnished them with an ample fund of practical suggestions, and we hope these will be forthcoming from those acquainted with the working of the coal in the Kanawha district.



EXAMINATION QUESTIONS

ANSWERED BY
JAMES T. BEARD

Miscellaneous Questions

(Answered by Request)

Ques.—The airway in a mine measures 5 x 10 ft., in section, where the anemometer indicates a velocity of 500 ft. per min. If the barometer registers 30 in. and the temperature is 70 deg. F. what is the weight of air passing through the mine in 24 hours?

Ans.—The sectional area of this airway is $5 \times 10 = 50$ sq.ft. Assuming the reading of the anemometer indicates the average velocity of the air current (500 ft. per min.), the volume of air passing is $50 \times 500 = 25,000$ cu.ft. per min. At a temperature of 70 deg. F., barometer 30 in., the weight of a cubic foot of air is given by the formula,

$$w = \frac{1.3273 \times 30}{460 + 70} = 0.07513 \text{ lb.}$$

The weight of air passing in the mine, in 24 hr., is then,

$$\frac{24 \times 60 \times 25,000 \times 0.07513}{2,000} = 1,352.34 \text{ tons.}$$

Ques.—A mine has two airways: A is 6 x 6 ft., in section; B is 4 x 8 ft., in section; what will be their comparative lengths, in order that they shall pass equal quantities of air, under the same pressure?

Ans.—First, write the formula for the unit pressure, in terms of the airway and the quantity of air in circulation; thus,

$$p = \frac{k l q^2}{a^3}.$$

For the same unit pressure and quantity of air in circulation, and the two airways having the same perimeter; $a_1 = 2(6 + 6) = 24$ ft.; and $a_2 = 2(4 + 8) = 24$ ft., it is evident that the length (l) of the airway will vary directly as the cube of the sectional area (a^3). In other words, the length ratio is equal to the cube of the area ratio; thus

$$\frac{l_1}{l_2} = \left(\frac{6 \times 6}{4 \times 8}\right)^3 = \left(\frac{36}{32}\right)^3 = \left(\frac{9}{8}\right)^3 = \frac{729}{512}$$

That is to say, in order that these airways shall pass equal quantities of air, under the same pressure, the ratio of their lengths is as 729 to 512. The first airway having the larger sectional area requires a greater length, to enable it to pass the same volume of air, under the same pressure as the second airway.

Ques.—What weight can be lifted with a jackscrew that requires two revolutions to raise the weight 1 in.? The length of the lever is 20 in. and the force applied at its end, 100 lb. Disregard friction.

Ans.—The circumference of a circle having a radius of 20 in. is $2 \times 3.1416 \times 20 = 125.66$ in. The work performed by a force of 100 lb. applied at the end of this lever, in making two revolutions of the screw, is $2 \times 125.66 \times 100 = 25,132$ in.-lb. Since the screw lifts the weight 1 in. when making two revolutions, the

weight lifted, in this case, is 25,132 lb., or 12.566 tons, ignoring friction.

Ques.—What horsepower will it take to hoist 1,200 tons of coal in a shaft 525 ft. deep, in 8 hr., the resistance of the ropes and pulleys being $12\frac{1}{2}$ per cent?

Ans.—Allowing $12\frac{1}{2}$ per cent for friction, the effective work is $100 - 12.5 = 87.5$ per cent, and the required horsepower is, therefore,

$$H = \frac{1,200 \times 2,000 \times 525}{0.875 \times 8 \times 60 \times 33,000} = 90.9 \text{ hp.}$$

Ques.—If a mule performs 10,000 units of work in one minute, while walking at the rate of three miles per hour, what is the pull on the chain?

Ans.—Walking at the rate of 3 mi. per hr., the mule travels $(3 \times 5280) \div 60 = 264$ ft. per min. The pull exerted on the chain is then $10,000 \div 264 = 37.87$ lb.

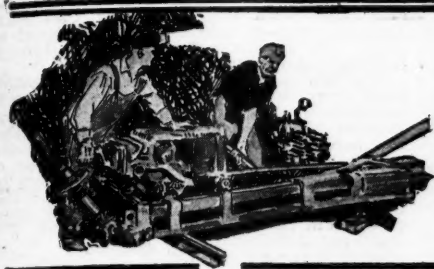
Ques.—If a room, turned at an angle of 30 deg. with the entry, is driven 300 ft. what will be the shortest possible distance to connect the face of the room with the entry; and how far along the entry will the place require to be started?

Ans.—The shortest distance, from the face of the room to the entry, is in a line drawn at right angles to the entry. The length of this line is $300 \times \sin 30 \text{ deg.} = 300 \times 0.5 = 150$ ft. This distance is measured from the center line of the room, at the face, to the center line of the entry, when the length of the room is measured from the center line of the entry to the face. The distance between these two points of measurement, on the entry is $300 \times \cos 30 \text{ deg.} = 300 \times 0.866 = 259.8$ ft.

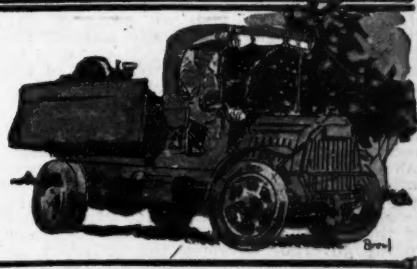
Ques.—A gaseous mine is divided into three sections, A, B, C. Section A contains a firedamp mixture consisting of one part of marsh gas and ten parts of air. Section B is likewise filled with a mixture consisting of one part of marsh gas, with less than ten parts of air. Section C is filled with a mixture consisting of one part of marsh gas and more than ten parts of air. The gas being ignited in Section A, where would you expect to find the most violent explosion, and which section would be the most dangerous to explore after the explosion?

Ans.—The mixture of gas and air, in section A, very closely approaches the maximum explosive point of the firedamp. It is in this section, therefore that the greatest violence would be manifest.

Of the other two sections, Section B would be the most dangerous to explore after the explosion had taken place. The reason for this is that the mixture, in that section, contains less air than what is required to burn all of the carbon in the marsh gas, to carbon dioxide. As a consequence, a greater proportion of carbon monoxide is formed in this section. On the other hand, in Section C, the air being in excess, a larger proportion of carbon dioxide and less carbon monoxide results from the explosion.



COAL AND COKE NEWS



Charleston, W. Va.

Cars from the West permit or slightly larger production during second week of February. Yet mines here work only half-time. Severe weather checks movement of empties. Influenza generally prevalent. Some Kanawha mines receive no cars for week or more. Influenza bad in some sections of Kanawha field. No coal exported. In New River region mines work one-third time. Sickness general here. Does not curtail production with no cars to load.

With a somewhat larger flow of empties from the West during the early part of the second week of the month, more cars were available in this section; yet by the time all the cars had been distributed in the various fields, served by the Chesapeake & Ohio, the increase was almost imperceptible and yet for a day or so did serve to give impetus to production. This probably resulted in a somewhat larger output than during the first week of the month, though the increase was not such as to inspire any great amount of enthusiasm, since the car shortage was sufficiently serious as to materially limit the operation of mines.

As illustrating how the supply slid downward from day to day, on Monday the loadings on the Chesapeake & Ohio were 139,000 tons; on Tuesday, 82,150 tons; on Wednesday, 71,000 tons; by Thursday they were down as low as 61,000 tons. Aside from the supply for the first two days, cars were only numerous enough for half the requirements of mines, therefore, working time amounted to about half of a full week. Severe weather on the fourteenth, fifteenth and sixteenth checked the further increase in movement of empties from the West. It is now the general belief that there will be little relief from the present car shortage until the weather becomes milder and until export shipments are resumed on a general scale permitting a quick return of cars to the mines.

Influenza was generally prevalent in this section, but in itself it had no direct bearing on the volume of coal produced or not produced, since such working forces as were available were able to load all the cars which were furnished. The epidemic has not proved to be as serious as it was in October, 1918. Railroads have been as much affected by it, however, as have mining operations.

Kanawha Works Half Time

Even though cars were somewhat more plentiful, as far as the Kanawha district as a whole was concerned, during the week ended Feb. 14, there was still a most pronounced shortage of equipment in the Kanawha field during the greater part of the week. With the mines of the field producing only from 10,000 to 15,000 tons a day, it will be apparent that mines were able to work only about half-time or less. It was not uncommon during the week to hear of cases where mines had received no cars for a period of a week or ten days, especially on branch lines. With mines idle so much of the time producers are way behind with their deliveries and this, of course, has brought about a condition in this section at least where there is no free coal. Many mining communities in the Kanawha region were fighting against another influenza invasion, a number of camps on Cabin Creek, Coal River and in the neighborhood of Winifrede reporting quite a large number of cases. Even so much sickness failed to hamper operations materially, owing to the scarcity of cars. No coal from the Kanawha region is being exported at the present time.

New River Small Output

If the car supply was conducive to larger loadings in other fields, such was not the case in the New River district during the week, loadings being leaner there, if anything, than during the week ended the seventh. In fact the car supply was so execrable that on Thursday, Feb. 12, only

5,150 tons of coal were loaded in the large New River field. The large supply of cars on Monday enabling the mines to produce about 23,000 tons was only an artificial supply. It is doubtful if mines worked more than two days out of the six, that, of course, meaning about a 30 per cent car supply. Instances were not lacking where mines had no cars during the entire week. No mines had enough cars for a full day's work at any time and much valuable time was lost. Though it does not seem that there will be any railroad strike in the near future, coal operators believe that conditions could not be much worse even with such a strike in effect. With sickness general among the miners in the New River field, it did not curtail production, owing to there being so few cars to load. Coal for export continues to be shipped from the field but permit requirements make it a cumbersome way of doing business and export tonnage is limited.

Bluefield, W. Va.

Conditions going from bad to worse in southern West Virginia. Serious car shortage. Due to severe winter weather and limited export tonnage. Rapid spread of influenza. Government confiscates West Virginia coal for Pennsylvania R.R. Tug River mines do not work half time. Winding Gulf plants work two days in six. Pocahontas works three days in the week. Considerable influenza here.

The stumbling block to anything approaching a normal production in the mining fields of southern West Virginia during the second week of February was a car shortage of a most serious nature. Transportation conditions were not even on a par with those prevailing during the previous week. General conditions in the southern part of the state have been going from bad to worse almost continuously since the first of the year. Relief now seems remote, even the Railroad Administration admitting it is helpless to afford any relief. Only half-enough cars were supplied, so that for at least three days of the week mines were in idleness.

While not all operations in southern West Virginia felt the serious effects of sickness among the miners, yet the rapid spread of influenza at various mining communities since the first of February has undoubtedly augmented other sources of loss in output as well as affecting railroad operations. That in turn, of course, has been felt in a retarded movement of coal and in a slower distribution of empties.

Two factors are now conspiring to prevent a better car supply in southern West Virginia. One is the severe winter weather beginning on the fourteenth. That prevented a large movement of empties from the West. The other factor is the limited export shipments. Until there is a full run of export tonnage there will be more or less of a short car supply, owing to the longer distance loaded coal cars must travel.

While no confiscation of smokeless coal is being reported, yet high volatile from southern West Virginia and from southwestern Virginia is being taken, orders, for instance, having become effective on Feb. 9 to confiscate 600 cars of coal from the Thacker and Clinch Valley fields, this being done at the Bluefield scales. Such confiscation is being continued at the rate of 25 cars a day. What is peculiarly significant in this connection, however, is the fact that the coal is being taken for use by the Pennsylvania R.R. West Virginia operators cannot understand why the Pennsylvania R.R., running through a bituminous field, should use West Virginia coal; unless it is that central Pennsylvania operators will not make contracts with the railroad and, further, that they enforce the payment of contract prices when coal is confiscated. There seems to be no reason why the Government should confiscate West Virginia coal for use on the Pennsylvania R.R.

Loadings in the Tug River field for the week ended Feb. 14 amounted to only 66,600

net tons, which is below the loading of the previous week. Cars were so scarce during the period mentioned above that a considerable number of mines in the field were not able to work even half time on account of not having enough empties. The outlook for the third week of February indicated that it would be the slimmest from a production standpoint since the second week of January, when loadings slumped to 55,000 tons.

Winding Gulf Works Two Days

How little and not how much coal was produced in the Winding Gulf field during the second week of the month may be imagined when it is stated that the car supply in that field was not sufficient to keep the mines operating more than two days throughout the week, the supply amounting to about 35 per cent of requirements. According to the operators there does not seem to be any immediate hope of more than a 40 per cent car supply. Both the Chesapeake & Ohio and the Virginian were at fault in the small number of empties furnished. Nearly all Winding Gulf coal is moving eastward at the present time, some of it for export, all export shipments being under special permission, however.

Pocahontas Sharp Decline

A description of conditions existing in the Tug River field also applies with equal force to the Pocahontas district, covering production for the second week of February. There was a sharp decline in the output during that period as compared with the previous week, and a more pronounced shortage of cars than had been in evidence in recent weeks was the principal cause of this sharp decrease. There were not half-enough cars on hand to supply the mines. Consequently, half the working time of the week was lost or, in other words, mines were limited to about three days work for the week. With weather conditions extremely unfavorable no relief from the car shortage was anticipated during the third week of the month. There has been considerable influenza among the miners of the Pocahontas region since the seventh, but while the complement of men at some plants has been greatly reduced by the malady other plants have escaped a visitation.

Frankfort, Ky.

Bill introduced in Kentucky Legislature creating a state Geological Survey. Old Department of Geology and Forestry outlawed. New act to fill the breach. Scope of the new survey outlined, duties of the director noted and provision made for proper assistance to carry on the survey work. Co-operation with Federal departments arranged for. Reports and publicity of survey work to be authorized.

A bill was recently introduced into the Kentucky Legislature by R. Lee Stewart to create a State Geological Survey. This bill has the following provisions: The Kentucky Geological Survey is to be created and established with a single executive officer, designated as the Director and State Geologist with headquarters at Frankfort, Ky., where are kept the geological collections, records, maps and accumulated property of former state surveys.

The governor of the state is to appoint the director of the survey, subject to the consent of the senate; this officer is to be qualified in a thorough, scientific and practical knowledge of the sciences of geology, mineralogy, hydrography and allied subjects. The director shall have had at least six years' collegiate and technical training in geology and shall be a graduate in geology from a recognized university. He shall hold his office for four years, unless removed sooner by the governor for inefficiency, incompetency or misconduct. It shall be the duty of this director and

state geologist to administrate the affairs of the survey; to visit all parts of the State of Kentucky and make himself familiar with the needs of each section; to supervise, outline and edit the work of his assistants; to advance the interests of Kentucky by presenting in person or otherwise, before national geological meetings, authoritative statements of the geological and mineral resources of the state; to undertake such field work as his time will permit, and to perform such other duties as may properly pertain to his office. He shall be responsible for the accuracy of the work of the survey, and make a biennial report to the governor covering the activities accomplished by and proposed for the State Geological Survey.

Activities of the Survey

Should time permit the director may lecture at the state universities on subjects pertaining to the geological and mineralogical development of the state, but without special financial remuneration for such services. Under the direction of the state geologist, careful geological, mineralogical, chemical, physical and soil surveys of the state shall be made; mineral and metalliferous deposits are to be located and specimens of such minerals and metals collected, analyzed and classified.

Provision is made for the employment, by the director, of competent assistant geologists, paleontologists, topographers, surveyors, specialists and such other assistants as may be required for the proper conduct of the affairs of the survey.

The bill directs that the Kentucky survey shall co-operate with the State Experiment Station, the U. S. Geological Survey and other governmental departments; provided first that such departments shall furnish an amount of money equal to that allotted for such work by the Kentucky survey, and second that such co-operative agreements shall prove advantageous to the state of Kentucky. The salary of the director is to be \$3,000 per annum.

The reports of the survey shall be prepared as rapidly as possible and shall be reviewed, edited and approved by the director. Furthermore the director is authorized to publish in the daily and weekly newspapers, trade and technical journals, magazines or in pamphlet form any geological discoveries or results of special interest. No reports or maps prepared by the Kentucky survey shall be sold, but nominal charges to cover postage may be made.

For the purpose of carrying into effect the provisions of this act, the sum of \$15,000 is to be appropriated annually to cover all field, laboratory and office expenses; the further sum of \$12,500 is to be available for co-operation with the U. S. Geological Survey; provided, in this latter case, that if such co-operative work is not being conducted to the best advantage of the state, then Kentucky may withdraw from such an arrangement and the work be continued by the Kentucky Survey.

The law relating to the Department of Geology and Forestry has been repealed at this session of the General Assembly, and there are now no funds available for this work or to support a prospective geological survey; therefore an emergency is declared to exist which is to be met by this act and its appropriations.

Louisville, Ky.

Deplorable coal-car situation in the Southern Appalachian territory. Operators, thoroughly aroused, threaten to shut down and sue Railroad Administration. Conditions on Louisville & Nashville noted and compared with those on other roads. Numerous orders given which would have afforded relief. Orders not enforced and Railroad Administration held responsible.

It is said to be likely that individual operators of the Hazard, Harlan, southeastern Kentucky and eastern Tennessee districts, in that territory known as the Southern Appalachian district, may file heavy damage suits against the U. S. Railroad Administration, charging discrimination in distribution of coal-car supply. Figures extending back over a period of several months show that operators, on the lines of the Louisville & Nashville R.R., have suffered severely through poor distribution of cars, and movement of empties into other sections of the country, without providing for the operations of the Louisville & Nashville lines. It is charged that operators on the system in question have lost between \$8,000,000 and \$10,000,000 as a result of existing conditions in the past few months.

A telegram sent from Knoxville, Tenn., on Feb. 5, to B. L. Winchell, Regional Director of the U. S. Railroad Administration at Atlanta, asks why railroads in the South have failed to execute administration orders and turn over empties to the Louisville & Nashville at junction points as stipulated in orders. The number of pool and foreign cars turned over has been far below the stipulated figures, and since Jan. 28, the supply has been trifling, the Cumberland Valley division on Feb. 5, receiving but a 40 per cent supply. The telegram further said: "The situation is deplorable, operators threaten shut down and suit against the Administration. We urge mandatory execution of orders."

Operators along the Louisville & Nashville lines recently filed a statement of conditions, and J. E. McCoy, secretary of the Southern Appalachian Coal Operators' Association, filed the statement with the Railroad Administration, and made an appeal for removal of the discriminations, as the head of a committee that went to Washington for that purpose. The statement showed that while the car supply last August was 85 per cent for the country as a whole, the Southern region showed but 67 per cent and mines on the Louisville & Nashville had but 59 per cent. The situation was about the same in the following months with the Louisville & Nashville securing the smallest supply in the country. It was charged that the Southern region received 11 to 18 per cent smaller car supply and the Louisville & Nashville mines 20 to 25 per cent less than other sections since August. The supply since Jan. 1 has been the worst ever known, with many Louisville & Nashville mines working but a day and a half a week. It was shown that but 56.88 per cent of cars ordered from Jan. 1 to 17 were delivered to Louisville & Nashville mines, with some districts getting but 41 per cent.

Promises Not Kept

It is claimed that many promises were received, much correspondence handled, and arrangements made to move cars into the section from various gateways, but that the orders were not carried out. It is stated that inasmuch as the Railroad Administration has full charge of motive power and car supply, there is no reason for discrimination, and the operators on the Louisville & Nashville want what is due them.

Operators want relief before the railroads return to private control, and believe, that if present legislation placing direction of equipment in the hands of the Interstate Commerce Commission is enacted, that the discrimination will no longer be practiced. Reimbursement is sought for discrimination and resulting losses since Aug. 1.

It is alleged that railroads north of the Ohio are 1,900 cars short of an agreement to deliver an empty car for each loaded car turned over at terminals at Ohio River crossings, this shortage occurring within three weeks time. The Southern Ry. was ordered to give up 75 empties from car pool movements to the Louisville & Nashville, at Knoxville daily, but seldom has total deliveries amounted to 25 cars a day. At other junction points the condition has been about the same. It is charged that most of the cars that have been turned over are Louisville & Nashville cars and not foreign or pool cars. In fact delivery of pool cars ceased at Middlesboro on Jan. 26.

On Feb. 5, the car supply on the Cumberland Valley division of the Louisville & Nashville was but 35 per cent; Harlan County received no cars and was shut down tight; there were but 250 cars available at Middlesboro on Friday. J. E. McCoy claimed that the Southern Ry. lines have been supplying 60 to 70 per cent of requirements. According to Railway Administration records, there has been a fluctuation of from 88 to 39.59 per cent.

It is claimed that discrimination has resulted in reduced operations, resulting in losses of eight to ten millions of dollars that would have been avoided if the Louisville & Nashville mines had been given a fair percentage of such cars as have been available. Mr. McCoy stated that it was on this account that operators planned to bring suit against Walker D. Hines, as Director General of Railroads, that the suits would probably be filed by the Hazard or Harlan operators but that Tennessee operators on the L. & N. would probably join in. It is stated that litigation is almost certain to be filed if relief is not immediately given.

Mr. McCoy further said: "The operators are being bled to death by the inability to get cars. In fact every industry is suffering severely because of the transportation problem." He stated that it had been developed that empty cars are sent on long

hauls instead of being returned to home line roads with freight moving that way. Delivery of pool cars had been expected to offset this condition, but it failed through carriers not complying with orders.

Coal operators claim that the railroads have not been playing fair with the Louisville & Nashville which has been helpless in the matter of securing anything like her net ownership of cars. For months past the road has been constantly short of cars, and the total number of coal cars on her lines has been far below ownership figures. Other lines have accepted shipments, but failed to turn over empties. The Railroad Administration is held to be responsible for not enforcing its orders.

Ashland, Ky.

Northeast Kentucky output half of normal. Car shortage the cause. Railroads grabbing much coal. Mines forced to fill railroad contracts before other orders. Allotment commission mine ratings irritate operators.

Production in the northeast Kentucky field during the second week of February reached only 120,000 tons, or about 50 per cent of the potential capacity (237,000 tons), with car shortages alone representing 122,000 tons, or 49 per cent loss, and mine disability and labor shortage only one per cent. During the same period of 1919, the production was 95,000 tons, with "no market" responsible for the entire loss at that time.

Railroads have begun to confiscate northeast Kentucky coal indiscriminately, especially in the premium grades. Where coal is not being so confiscated, other mines having railroad fuel contracts are being forced to supply the entire contract requirements of the railroads, before furnishing other contract holders with their coal; the operators are under the penalty of having their coal embargoed unless they fall in line. This policy is stamped by operators as wilfully unjust.

The epidemic of influenza at Seco, Ky., where Government assistance was finally afforded, has abated somewhat. Reports from the Big Sandy territory disclose the presence of the disease in light form at scattered points in that region.

Operators of the northeast Kentucky field are quite irritated over the apparent arbitrary action taken by the allotment commission, in refusing increases to mine ratings, although in many cases considerable extension of plant equipment and greatly increased labor forces are shown.

There is an unusually heavy and insistent demand for all northeast Kentucky coal at the present time in all grades; but mines in this field are making no progress in meeting such demand with a car supply only equal to half of requirements and with the railroads literally grabbing all the coal they can get their hands on.

Norton, Va.

Southern Ry. refuses to accept bills of lading. Confiscates coal right and left. Vigorous protest by operators. Production 74 per cent of capacity. Influenza to further curtail output.

The Southern Ry. was still confiscating Virginia coal right and left, during the second week of February, for railroad use and was not permitting any coal to go forward for commercial purposes. This refusal to accept bills of lading and this disposition to appropriate all the coal produced, was denounced in vigorous terms by Virginia operators who protested most strongly against it, as they have been doing right along, but to no avail.

Production during the week amounted to 156,358 tons or only 74 per cent of capacity; losses were entirely due to car shortage, reaching a total of 52,900 tons or 25 per cent of potential capacity. Some 42,000 tons of coal was either coked or stored during the week, or production would have been reduced at least 20 per cent more than was the case.

Promiscuous confiscation of coal was working a great hardship on commercial customers depending on Virginia mines for coal. It was estimated that production would be curtailed to the extent of at least 30 per cent more, during the third week of February, because of the rapid spread of influenza over the field, most operations, in fact, having 30 per cent of their working force out of commission owing to illness of employees.

The output of 156,000 tons, during the second week of the month, represented a loss of about 4,000 tons as compared with the previous week's production.

Indianapolis, Ind.

State Geologist notes improvement in Indiana mining methods. Further saving in coal needed. Chief sources of waste stated. Higher prices tend to utilization of low-grade coal.

Improved methods of mining coal are eliminating much waste in Indiana, but there continues a large percentage of loss, according to a report issued by W. N. Logan, state geologist. Mr. Logan estimates that approximately 26,500,000 tons of coal are mined in Indiana annually. He says the waste here is greater than in other bituminous fields.

"In some states the waste has been reduced to 50 per cent of the coal mined, but the waste has not been reduced to this minimum in Indiana," Dr. Logan says. "And while the waste has been much greater in the past than it is at present, there is need of much greater improvement."

Waste in coal mining may be connected with the system of mining or it may be independent of the system, according to the report. The chief sources of waste in mining coal are: Not robbing the pillars in the room-and-pillar system; unclear mining in the strip-pit method; leaving coal containing partings in any system; producing unrecovered culm, leaving coal around horsebacks, bells, etc., and mining lower beds before upper ones. The principal systems of mining employed in Indiana include strip-pit method, the room-and-pillar system and the long-wall system.

Dr. Logan's report to the Department of Conservation shows that higher prices have had a tendency to decrease the waste of fine coal or culm, now utilized extensively in the industrial plants where there is a demand for coal of low heating power.

Victoria, B. C.

Government mining engineer notes new coal development on Vancouver Island, Canadian Collieries, Ltd., drills property; Canadian Western Fuel Co., Ltd., develops extensively. Nanoseo Wellington Coal Co. installs new equipment. Improvement at Cassidy Collieries.

Commenting on the coal-mining development on Vancouver Island, B.C., during the past year, Wm. M. Brewer, Government mining engineer, observes that two mines have been added to the active shippers. These are the No. 5 mine, at South Wellington, the property of the Canadian Collieries, Ltd., from which coal has been mined on a commercial scale since early in 1919 and the Wakesiah mine on the Wakesiah farm, property of the Canadian Western Fuel Co., Ltd., which began producing commercially about October, 1919.

"Amongst new development or prospecting work," Mr. Brewer continues, "there is the diamond drilling being done by the Canadian Collieries, Ltd., on the Tsa-abi River, which empties into Baynes Sound about five miles southerly from Union Bay in the Comox section of the Nanaimo mining division; also the reopening of the old slope by the Canadian Western Fuel Co., Ltd., on the Wellington seam, southerly from the Harewood mine. The slope of the latter company had been driven about 400 ft. and abandoned by the former management. During the past summer the old workings were unwatered and examined, with the result that General Manager George A. Bowen, ordered that the workings be reopened, extended and the mine placed on a producing basis. This may be worked as Harewood No. 2 mine, with a new railway connection; or the underground workings may be extended to connect with the haulage system in the Harewood mine and the coal transported through that mine to the transportation system now in use."

New Construction and Development

Mr. Brewer also refers to the transfer of the Grant mine, Nanoseo Bay, to the Nanoseo Wellington Coal Co., Ltd. Since the change of management considerable new construction and development work has been undertaken. This is itemized as follows: Two return-tubular boilers, 125 hp. each; one 150-kw electric generator; one electrically-driven centrifugal pump for coal washery and fire protection, capacity 450 gal. per min.; two storage tanks for fire protection and coal washery, capacity 25,000 gal.; a coal-washing plant including a jig washer, screening plant, picking table, loading boom and bunkers for three grades of coal, the whole to be electrically operated; a new office building, and other structures.

The underground development has been pushed steadily, consisting of a main east level and a counter level, (driven approximately 1,800 ft. in the last year) with stalls driven to the rise and a slope to the dip, and with entries turned off east and west. The mine is worked on the pillar-and-stall system.

Improvements are being made to the plant of the Cassidy collieries of the Granby Consolidated Mining, Smelting & Power Co., as their necessity becomes apparent. One of the most notable improvements completed here in recent months is a belt conveyor from the bunkers over the wharf to the scows. This makes loading a simple process. The mine is producing steadily, the product being shipped to Anyox for use in the company's byproduct ovens in the manufacture of coke for the smelter.

PENNSYLVANIA

Anthracite

Hazleton—The Lehigh Valley Coal Co., it is said, will connect its Beaver Meadow drainage tunnel with its Spring Mountain workings by a tunnel about 2000 ft. long. When completed this new tunnel will take care of the water from the Spring Mountain and Spring Brook workings.

Wilkes-Barre—The newly-constructed \$1,000,000 breaker of the Delaware, Lackawanna & Western company, at Edwardsville, which began operations recently, is said to be the last word in breaker construction and will prepare 6,000 tons of coal for the market daily. The building is 165 ft. high and occupies a ground area 210 ft. sq., or a little more than an acre.

Tamaqua—Eventually the use of electricity will become general in the mines of Lehigh, Schuylkill and Carbon counties, according to the statement made by leading officials at the Harwood Electric and the Lehigh Navigation Electric companies. These electric companies say that most anthracite operators now are anxious to electrify their collieries and that only the conditions created by the war and subsequent high prices have delayed the work. Up to this time the Harwood Electric Co. and the Lehigh Navigation Electric Co. have found it difficult to take on new business as the demand for power is so great that the machinery held for reserve cannot be kept idle. The extension of the Hauto plant has already been started, and when it is completed it is expected that every demand can be met.

Bituminous

Pittsburgh—In this district it is often necessary for men to work for sometime in coke ovens, making repairs, or inspecting ovens out of blast. On damp days the fumes from such ovens are most noticeable and are not only annoying but positively dangerous to those who must work in them. It has been found quite practicable for men so employed to wear an army gas mask while engaged in work under these conditions.

Brownsville—The Snowdon Coke Co., whose plant is near here, has just had a revolving-car dump installed at its works by the Car Dumper & Equipment Co., of Chicago, Ill. This dump is 265 ft. long and capable of dumping 28 cars in 12 sec., at one operation, without uncoupling or disconnecting the hoisting rope. This is said to be the longest dump of the kind ever installed. The Snowdon Coke Co. has discarded its wooden drop-bottom mine cars and installed new steel-bodied cars with tight wooden bottoms, furnished by the Koppel Industrial Car & Equipment Co. of Koppel, Pa.

KENTUCKY

Louisville—A bill before the state legislature to enforce mine operators and manufacturers to install bath houses for miners, has been amended to provide that such installations shall not be necessary where mines will be worked out within a period of two years. The Senate has passed a bill providing for miners to have the power to go outside of their own company to secure a scale inspector. There was a strong fight on this bill, it being alleged by the minority that the scale inspector should be picked from men employed by the mine in question.

OHIO

Columbus—Two important laws were passed at the recent session of the Ohio Legislature which affects coal operators in Ohio. One of the laws provides that all employers must keep their workmen's compensation premiums paid up in full or face

receivership proceedings. The other compels all employers to make out a full statement of the number of persons employed during the year.

Operators in Ohio are making a vigorous fight against the bill pending in the Ohio Legislature providing for a tax of 1 per cent on the market value of all minerals produced in the state. It is argued by coal men that such a tax would put Ohio coal operators at a disadvantage in competition with other states. A hearing on the bill before the house committee was attended by a large number of operators. No action has been taken on the bill and it is doubtful if it will be enacted into law.

ILLINOIS

Springfield—A severe car shortage exists in the Springfield mining district. Cars are enroute to western territories and will doubtless be returned to the Central states shortly, when it is expected that the car shortage will be remedied. The railroads are making every effort to minimize the shortage of coal cars. No coal carriers are allowed to be loaded with any commodity other than coal, and this order is strictly enforced in all territories. The result is that every car, when emptied, is immediately filled again with coal and all coal cars are kept constantly on the move. It is said that the Wabash R.R. was able to furnish only 14 cars to its local mines, when about 150 were needed and could have been used. This condition is unusual, however, it was said, and the roads average about a 50 per cent supply and will continue to do so for a number of days yet to come.

How the present conditions will be changed when the railroads are returned to their owners on March 1, is a matter of some concern.

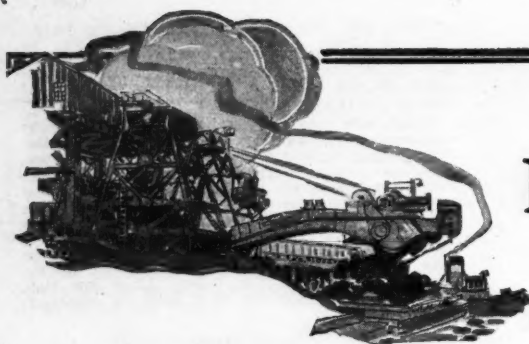
Obituary

James D. Simpson, general superintendent of the Berwind-White Coal Mining Co., died at his residence in Windber, Pa., of influenza-pneumonia on Feb. 11. Mr. Simpson was born in England, Jan. 29, 1878, and was brought to the United States by his parents (in 1879) who became residents of Ohio and later located in Pennsylvania.

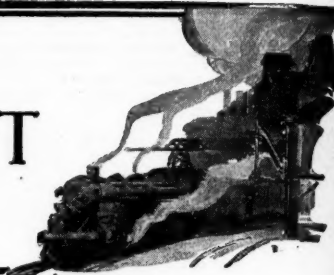
When ten years of age, Mr. Simpson started to work as a trapper boy in the mines of the Monongahela Valley. He later became a skillful mechanic but left the mining field temporarily to accept a clerkship with the Pennsylvania R.R. During this time he educated himself for the fu-



ture through the medium of correspondence schools. He was later connected with the White Rock Coal Co., the Ellsworth Collieries Co. and the Monongahela River Coal & Coke Co. Mr. Simpson left the last named company to accept the superintendency of the Ocean mines of the Berwind-White company, at Herminie, Pa. His achievements here led to his appointment in 1913 as superintendent of the Berwind-White mines with headquarters at Windber, Pa. He succeeded W. R. Calverly, now general manager of the Union Collieries Co. Mr. Simpson was president of the Windber Hospital.



MARKET DEPARTMENT



Weekly Review

Traffic Conditions Show No Improvement—Bad Weather Interrupts Car Movement—Operators Complain of Small Profits Under Present Conditions—Serious Situation Exists in Coke Region.

IT IS the belief of some that traffic conditions now existing are possibly the worst ever known, and the railroads are slow in recovering to a normal condition. Although the diversions and confiscations continue, they are not as frequent as they have been in the past. It is worthy of note that because the Seaboard Air Line R.R. confiscated cars intended for use at the power house of the Detroit Edison Co., a discontinuance of electric power service to all non-essential industries in that city has been considered by the officials of the company, unless immediate relief is obtained.

Operators are slowly receiving more

of the empty cars that were sent West to alleviate conditions in that territory, but this movement has been interrupted by the recent zero weather such as was prevalent in the Central West. This condition is only temporary, however, and will be remedied with the arrival of milder weather.

Inability of operators to run their mines with reasonable profit under present conditions is responsible for the failure of dealers to lay up a stock of reserve fuel, but demand for bituminous coal remains about the same as last week, and the only real complaint is non-delivery.

With the export ban on coal almost

complete with the exception of low-volatile gas-coal releases at Hampton Roads, Eastern mines are finding it difficult to run, the car supply being about one-third of normal. Had the export business continued in part, the mines might not have suffered so much as more cars would have been available in that section.

Except in only a few sections, there is heard little or no word of a lack of hard coal, and anthracite dealers are satisfied with the demand for their product. In the coke region, due to car shortage, a serious situation exists insofar as it relates to the future of beehive-coke production.

WEEKLY PRODUCTION

From the weekly report of the U. S. Geological Survey dated Feb. 21, the output for the week ended Feb. 14 was as follows: Bituminous—10,284,000; anthracite—1,773,000 and beehive coke—440,000 tons.

For the calendar year ending Feb. 14, 1920 the output was as follows: Bituminous—68,996,000; anthracite—79,443,000 and beehive coke 2,849,000 tons.

Atlantic Seaboard

BOSTON

Worst traffic conditions for years. Railroads recovering very slowly. Embargo not likely to be raised this week. Confiscations still general. Practically nothing received via New York and Philadelphia piers. Hampton Roads situation improves. But one "emergency cargo" thus far received. Anthracite quiet, but shipments far in arrears. Only moderate inquiry for steam sizes.

Bituminous—Railroad men are agreed that the recent storm caused the worst tie-up in their experience. Two-thirds of New England's supply comes all-rail, and until the congestion is cleared up on the roads here as well as on the intervening lines there is little chance of any free movement of coal. Several days of thaw are needed to release the thousands of cars that are frozen to the tracks. At yards like those at Worcester, Providence, and Boston there are long lines of cars ice-bound to the hubs, and the result is almost a total cessation of West-bound movement. A week ago there were days when not a single car was taken by the New York Central from the New England roads, and at this writing very few of the cars started from the mines before Feb. 5 and those in transit have yet reached the gateways. There are cases where coal shipped since the storm has come through, but coal that was then on sidings seems for the most part effectually blocked.

Anthracite—Except in a few scattered communities there is heard little or nothing

of any distress for hard coal. This is the more remarkable when it is realized that not only does the blanket embargo apply to anthracite as well but that the latter has been embargoed from points on the New Haven R.R. since Jan. 16. The water movement has slowed up materially since the storm, the movement of barges having been attended with a great deal of difficulty. There are many cases of serious ice damage that have called for extensive repairs.

One important sidelight on the general New England situation is the very narrow and restricted market for steam sizes. Of course they are now embargoed with the rest, but right up to the date of the embargo there was only an apathetic interest on the part of steam users who usually rely upon bituminous. The trade feels there cannot be a great deal of apprehension, outside of the railroads, so long as this remains a characteristic of the market.

PHILADELPHIA

Anthracite demand shows little sign of easing off. Winter weather still prevails. Receipts of needed sizes fall off. Big call for nut. Stove and egg strong. Pea unsatisfactory. Delivery conditions somewhat better. April reduction likely to be passed again. Buckwheat active; other steam sizes quiet. Bituminous shortage grows. Consumers plead for coal. Plants down. Object to diversions.

Anthracite—Without a doubt more coal has been burned thus far this season than in the entire winter last year, and as a consequence the trade is experiencing the strongest kind of demand for more coal. With a couple of months of coal-burning weather still before them the consumers are not slow in appreciating the fact that there must be coal in the cellar to replace the tonnage which has been burned. Of course it is altogether likely that we have gone through the most severe weather, but the experience has always been that from the first of March right up to the end of April a good tonnage of coal is needed to care for this market.

Bituminous—The industries of this territory are in serious straits for fuel and the reports of plants closing down are

becoming common. In many respects present conditions are worse than during the strike last November.

NEW YORK

Coal continues scarce as demand for all sizes of anthracite increases. Transportation difficulties and frozen conditions at piers principal reasons for shortage. Dealers handicapped in making deliveries through bad traffic conditions. Yards running short of coal. Public utilities in no immediate danger.

Anthracite—There continues still to be a shortage felt of the domestic sizes. This shortage is being aggravated by conditions in the regions which to a certain extent are slowing up production. Winter conditions at the piers prevents dumpings of normal capacity. The thawing process which must still be resorted to, as practically all cars are frozen solid through, takes time and dealers are securing not more than one half of their normal supply.

Current quotations for company coals, per gross ton at the mines and f.o.b. tidewater at the lower ports are as follows:

	Mine	F.o.b. Tidewater
Broken	\$5.95	\$7.80
Egg	6.35	8.20
Stove	6.60	8.45
Chestnut	6.70	8.55
Pea	5.30	7.05
Buckwheat	3.40	5.15
Rice	2.75	4.50
Boiler	2.50	4.25
Barley	2.25	4.00

Quotations for domestic coals at the upper ports are generally 5c. higher on account of the difference in freight rates. Independent shippers are securing 75c. over the above prices on egg, stove and chestnut. About 20c. on pea.

Bituminous—The placing of various embargoes on coal coming to tidewater and the congestion at the piers is a very disturbing factor in the soft-coal market. For a while, but few consumers on the Pennsylvania road, the Jersey Central and Erie east of Trenton were permitted to receive consignments.

BALTIMORE

Export ban now claimed to be the hub of present domestic shortage in East. Central Coal Committee fails to give relief. Car supply at mines very bad. Anthracite conditions improving.

Bituminous—With the export ban on coal almost completely effective as far as New York, Philadelphia and Baltimore are concerned, and complete with the exception of some low-volatile gas-coal releases at Hampton Roads, some leading coal men are advancing the idea that this very condition is causing the present critical domestic shortage in the East through failure to provide sufficient cars for Eastern mines while the production of other districts is reported to be the largest in years.

The price situation is somewhat complex. A very little government price coal is in the market, but the majority of coal is on contract or sold undoubtedly above the government price. Some producers are saying openly that they will quote up to \$3.50 and \$4 because they can not produce at a profit at \$2.75 or \$2.95 and that the Lever Act assures producers of a "fair profit."

Anthracite—Conditions in the anthracite trade here are improving. The supply has run easier at a time when the shut down on bituminous came. And some dealers are short of particular sizes, but despite the increased call for late coal by consumers who burned more than they had anticipated, the distribution has been pretty good.

Eastern-Inland

PITTSBURGH

As far as Pittsburgh is concerned, the industry seems to be well taken care of in regard to coal supplies, although the car shortage is felt here. River transportation is very heavy, and a great deal of coal is coming down from the pools and quickly snapped up by the mills and industrial plants in this district.

The mines are working full time, but it is evident that a great improvement must necessarily take place in the return of empty cars from the seaboard before long if the miners are to be kept at work. Further West from here there is a change in the coal situation, and there are several things that enter into the problem of the Central West operators.

Lack of railroad cars and motive power, together with the inability of the operators to run their mines with a reasonable profit under present conditions, is responsible for the failure of the mines to lay up a stock of reserve fuel, or for the mills to depend on any more than will run them from day to day. R. W. Gardiner, of Pittsburgh, commissioner of the Coal Producers Association, is of the opinion that bad business conditions will be upon us unless the miners are placated with better wages and more convenient working conditions.

COLUMBUS

Still further reductions in car supply at all Ohio mines has curtailed production. Scarcity of stocks in many sections is reported, and some suffering results. Good demand for both steam and domestic sizes is reported.

With the influenza epidemic disabling train crews, cold weather in many sections and the wide distribution of cars during the suspension, the car supply in Ohio is still further reduced. In previous weeks the average supply in Ohio was estimated at between 45 and 50 per cent of normal, but during the past week the supply has been reduced to about 30 to 35 per cent. This is causing a good deal of trouble both to producers and consumers and the end is not yet in sight. Those in a position to know say that there is no immediate hope for an improvement in the car supply and not much increase in production can be expected soon.

Steam users are now about as clamorous as retailers for coal. Many of the larger users have no reserves and are being operated from hand to mouth, as it were. This is true of public utilities and public institutions. Railroads are taking about 50 per cent of the available tonnage for steam purposes, which reduced the coal delivered to plant to a very low point. Rubber factories had rather large stocks and still have some reserve stocks.

CINCINNATI

The market in this territory is in a very tight situation for fuel for domestic as well as for industrial uses. Business here

was never as demoralized as it is at present. The car shortage is growing worse daily and reports from the non-union fields of West Virginia which did more than their share during the strike have received only five-days car supply during the past twenty-one days.

The numbers of buyers on the market are increasing daily, and some leave this territory with about as much satisfaction as they entered. Operations in the West Virginia and Kentucky fields have worked but about two and one-half days in the past three weeks. The domestic situation here is not so bad as in other places, as daily arrivals are taking care of current demand.

Reports show that more coal is being burned here than in any winter previous despite the fact that we have experienced only a week or two of extreme cold weather. As regards the retail trade demand is in excess of supply principally as a result of labor shortage. Retailers state that they could cope with the supply if they were able to obtain sufficient help.

There is little free coal to offer. There is no set price other than that ordered by the government, but that is a myth. Reports from the various districts of which this city is the gateway show that coal is still being confiscated for railway use. The river is helping to take care of the situation and during the past week heavy tows arriving helped to ease the local situation. Many box cars which were loaded with coal at the mines to help relieve the situation are being unloaded here at a loss of time. There seems to be no relief in sight and no prospect of obtaining an improvement in the car supply before next month.

A fair demand exists for steam coal on account of the fact that the industries in this locality are all working at approximately maximum production. Dealers are beginning to build larger bin capacity to store more coal for the fall and winter months of next year. No one knows what way to turn and there are plenty of firms still trying to get the money that is due them for coal that was confiscated and delivered two or three months ago.

Southern

LOUISVILLE

Cold weather resulting in heavier demand on retailers, whose stocks are exhausted. Deliveries very light, but milder weather relieving demand somewhat. Steam grades in excellent demand. Production continuing light due to car shortage.

Retailers faced a heavy demand for coal for a few days starting Feb. 14, when there was a sharp spell of weather. Yards are practically empty, as deliveries have been poor for the past ten days. Milder weather is relieving the pressure somewhat, but back orders are taking care of deliveries of domestic sizes as fast as they can be had. There is a steady demand for all grades of steam coal, resulting in the market being well cleaned up, with no spot coal being offered to speak of.

Production at the mines continues at the rate of two or three days full work weekly, as the car shortage is not showing much improvement, and deliveries are very uncertain. Nothing new has come up in connection with the threatened suits of operators on the Louisville & Nashville lines against the U. S. Railroad Administration for losses caused by discrimination in the matter of car supply, although action is likely at any time.

BIRMINGHAM

Shortage of cars delaying movement of coal and also cutting production materially. Trade active with indications of a stronger demand developing. Labor shortage results from sickness in many camps.

Brokers and distributing agencies report a very active demand for all grades of coal, and, due to operating conditions, under which production is being very much restricted, predict a stronger market will soon develop. The mines are all behind on deliveries against contracts and the filling of spot orders is also suffering delay on account of the lack of cars for loading.

The spot inquiry is good and there is also a substantial amount of contract business being offered, some of which is being booked subject to the regulations of Government price control and with a clause inserted allowing a 14 per cent increase over Fuel Administration prices in case restrictions are removed during the life of the contracts.

Export inquiry is being made but there is no coal available for the foreign trade at this time and none of this business is being taken on. Additional towboats provided on the Warrior River increased shipments of coal to Mobile and New Orleans from mines in the Warrior field.

Lake Region

BUFFALO

Again the multiplied blizzards. Much risk of a bituminous famine, but no report of it yet. Some cars moving now. Anthracite shut off temporarily.

Bituminous—Two zero periods in one week, the first with much snow and wind, ought to be about the final effort of the weather this winter to do its worst. We call the shipping tie-ups worse this winter than they were two years ago, even if they stop now. February opened mild and for two weeks it promised to let up for the season. Then suddenly on the night of the fourteenth it shut down again and the car situation has been a matter of stand-still mostly since, for one blizzard was over but a single day before the next one followed.

Still the shippers and the roads have worked together better than they did last month and they have kept the coal moving to the most needy consumers, so that the complaint has not been as great as was expected. If the worst is now over, as it seems to be, the public will have great reason for joy, for the risk has been great of a general famine. In the deep snow the trains could move only on the expenditure of a great amount of work and it often happened that cars or locomotives got off the track in the drifts and made matters still worse. We do not usually like to see the snow go, but a shower of rain would be welcome now.

Anthracite—For some days after the fourteenth the supply was almost entirely cut off. The Lackawanna R.R., which brings in most of it, had much difficulty with snow, and, besides, some snow-plow wrecks to contend with, so that for a day or so nothing passed over the line. Other roads were not much better, and if it had not been for the fact that the consumers were pretty well supplied there would have been many a house without fires for days. As it was the shortage was somehow tided over, just how it was done nobody but those who did it being informed.

Buffalo is so near to Scranton that it has always been felt that an anthracite famine was about out of the question, but the margin has been so small in late years that no safety was enjoyed and it is now the general idea that there will be none till there is a large amount of coal stored permanently, either in the large cities or at junction points where it can be obtained quickly, either by means of local trains or trucks. The consumer will have to pay, but he is getting used to that.

TORONTO

Anthracite in active demand—Shipments delayed by snow blockade, but conditions improving—Great shortage of bituminous—Prices increased owing to exchange.

Continued cold weather, during which the stocks laid in by many consumers were exhausted, has caused an active demand for anthracite. Shipments from the mines have been considerably delayed by the snow blockade at the Niagara frontier, and the shortage became serious.

The situation has lately been relieved and a fair amount of hard coal is now coming forward. Hardly any soft coal is being received owing to the confiscation of shipments for railroad use, and great scarcity prevails. Prices have advanced on account of the high rate of American exchange.

CLEVELAND

Although stringency still prevails, the local coal market is much easier. Headway toward returning empties is reflected in increased operations at southern and eastern Ohio mines, and in turn by larger receipts here.

Bituminous—Another week of near-zero weather has further strained the local coal trade, but as has been the case all along, minimum requirements have been met. Diversions to meet the needs of the leading public utility have ceased, and the position of dealers is thereby better. It is estimated that receipts in the past week have been from 35 to 45 per cent of normal. In some cases small reserves—from two days to a week's supply—have been built up.

That the situation in Cleveland is easier than that in nearby districts is seen from the fact that steam-coal users, even from Pittsburgh, are seeking supplies from Cleveland operators. The present scarcity is more market in slack than in mine-run. Hope that Government price maximums would be lifted March 1 has all but been abandoned, with supplies so low. In most cases operators are rationing their output among regular customers, and "shoppers" are now getting short shrift.

Domestic bituminous demand is increasing every week. Stocks laid in last fall, on the average, would have sufficed for a normal winter, but the drain has been so heavy domestic consumers have been forced into the market again. In meeting this demand, coal dealers are more handicapped by a shortage of labor than by a shortage of coal. Here too available coal is being rationed, and domestic consumers limited from a one to one and a half. Dealers' supplies are streaky—one day they will have nothing but Masillon lump and the next nothing but No. 8 Pittsburgh—and domestic consumers must take what dealers can give them. Prices on all grades of steam coal remain unchanged.

The past few days have seen the railroads making more headway returning empty cars to the mines. This improvement has been interrupted by the recent zero wave, but this is expected to be only temporary and operators hope the peak of the shortage has been passed. Cars from Buffalo and Eastern points are slow in returning, but from the West better service is being rendered to eastern and southern Ohio mines.

Pocahontas and Anthracite—Pocahontas continues to come through in good shape, but last week's storm appears to have set anthracite movement back seriously. Dealers are getting about half of the Pocahontas they could sell, but not more than a quarter of the anthracite they seek. On about half the days of the week dealers can supply either grade; on the remaining days they substitute coke or bituminous. Domestic demand for Pocahontas and anthracite is heavy, buying last fall having proved inadequate to meet the needs of the severe winter. Owing to the influenza epidemic, dealers' delivery forces are about one third short.

Lake Trade—An inkling of what may be expected to happen to Lake Superior and Lake Michigan coal rates in the coming season may be gained from the fact that Canadian tonnage of 250,000 tons of bituminous coal to Montreal this season has been contracted for at \$2.50 a ton. This is an increase of 50 c. per ton over the 1919 rates, when ocean-going steamers built on the Grate Lakes for the Emergency Fleet Corporation loaded coal for Montreal on their way to the ocean and competed with the Lake lines. The Canadian coal will be loaded at Cleveland and Lake Erie ports to the East. It is not expected, Lake Michigan and Superior coal rates will be fixed before the middle of March.

Retail prices of coal per net ton delivered in Cleveland are:

Anthracite—Egg, \$12.20 @ 12.40; chestnut, 12.50 @ 12.70; grate, 12.20 @ 12.40; and stove, 12.40 @ 12.60.

Pocahontas—Shoveled lump, \$9.00 @ 9.25, and mine-run, 8.00 @ 8.25.

Domestic bituminous — West Virginia splint, \$8.30; No. 8 Pittsburgh, 6.85 @ 7.00; Massillon lump, 7.40 @ 7.65; Cannal lump, 11.00; and Coshocton lump, 7.35.

Steam coal—No. 6 slack, \$5.75 @ 6.00; No. 8 slack, 5.80 @ 6.00; Youghiogheny slack, 5.25 @ 6.10; No. 8 1/2-inch, 6.35 @ 6.60; No. 6 mine-run, 6.30 @ 6.85; and No. 8 mine-run, 6.30 @ 6.85.

DETROIT

Detroit faces curtailment of Detroit Edison service due to diversion of the company's coal supply to railroads.

Bituminous—Discontinuance of electric power service to all non-essential industries will be necessary, within five days, according to representatives of the Detroit Edison Co., unless immediate relief is obtained, increasing that company's coal supply. This announcement follows the seizure Monday of 26 cars of bituminous coal just after their arrival in Detroit and while awaiting switching to the company's yards, and the notification later the same day that a West Virginia mine that has a contract to supply the company with up to 20,000 tons a month must turn over its output to the Seaboard Air Line R.R.

It is explained by representatives of the Detroit Edison Co. that the mine had a contract to supply 5,000 tons a month to the railroad but having been unable to get sufficient cars to meet the terms of its

contracts has been making a pro rata delivery. The Railroad Administration's order requires the mine to turn over 5,000 tons a month to the railroad and forbids loading coal for any other customer until it has made good all deficits on earlier deliveries to the railroad.

J. W. Brennan, purchasing agent of the Detroit Edison Co., says that 2,100 cars of the company's coal were confiscated by the Railroad Administration during the recent miners' strike and that approximately 50,000 tons have been lost from the company's reserves within the last 30 days. It is now necessary, he says, to secure sufficient coal to meet the company's daily requirements and to replenish its depleted reserves.

Various other Detroit industrial and manufacturing plants are facing a similar shortage in supply. Even assuming that the mines are again loading coal for Detroit and Michigan, jobbers feel there is little assurance that coal will be sent through in sufficient quantity to afford relief. Lack of railroad motive power and car shortage are likely to prevent much coal getting into Detroit, they say.

Anthracite—Because of the extremely cold weather early in the week, there has been considerable increase in demand for anthracite, with the result that stocks in retail yards are greatly reduced. Shipments are not coming in very freely, while the transportation situation has been disarranged by storms in the East.

Middle West

MIDWEST REVIEW

Cold weather, and the car shortage have both contributed in some degree in keeping the market very strong and steady. A number of our best known operators and wholesalers are refusing to take business calling for shipment at any specified time, as the congested condition of their order books does not warrant it.

It will take full running time for a number of weeks for the operators to catch up on old and delayed orders. Some firms are not taking additional business, while some are taking business with the understanding that the coal will be shipped as soon as they can get around to it, and not before, which means that shipments will probably move forward some time in the middle, or latter part of March.

There has been no noticeable improvement in the car supply. In fact, the supply this week has probably been even worse than last week, although it is a little early to obtain any accurate figures. To give a comprehensive idea of the situation we will take, for example, a company with a number of mines in the Franklin County field, has a daily output of but 25,000 tons. Mines of this company are served by the Illinois Central, the Chicago, Burlington & Quincy, the Chicago & Eastern Illinois and the Missouri Pacific.

CHICAGO

Anthracite shipments are not coming into this market as rapidly as could be desired, and while there is not an actual shortage, a number of people who heretofore burned hard coal, are now burning soft coal.

Eastern coals are increasingly hard to get, and are in great demand. If the Government restrictions were removed, Eastern coal from West Virginia and Kentucky would be selling at a decided premium. The retail trade are nowhere near as independent today as they were a week or so ago. They are looking for coal, and looking for coal to be shipped promptly, and they are having some difficulty in finding what they are after.

ST. LOUIS

The greatest car shortage in history prevails in the Middle West. Incompetent management of railroads responsible for this lack of motive power and disregard of property rights.

The local condition, while it is not satisfactory, is good, everything considered. St. Louis is short of domestic sizes of coal and also short of steam, but it is nothing compared with outlying districts. A few embargoes still prevail on some of the Western lines and this forces a market in St. Louis.

In the Standard field the working time has gone down to about two days per week and some mines do not work that much. The two days car supply may be distributed over a period of four days, a few hours each day.

If it were not for Government prices coal in this field would be going at as high as \$5 or \$6. The miners are dissatisfied and say they cannot live under these working conditions. In the Mt. Olive district conditions are a little better, but in a general way similar to those in the Standard field.

MILWAUKEE

Shortage of coal and inadequate supplies by rail promise to precipitate an advance in prices all around. Popular grades of anthracite not to be had.

A pressing demand for coal, with exhausted stocks and an uncertain supply, makes the coal situation at Milwaukee very unsatisfactory. Prices remain unchanged, but dealers contemplate an advance as soon as they can offer sufficient reason for so doing.

They say that reason exists now, but the public will have to be convinced before the step will be taken. Bad weather and interrupted rail traffic will precipitate an advance. The only hard coal obtainable at present is egg and buckwheat. Mine run is the only grade of Pocahontas to be had.

Coke dealers defend the advance in this class of fuel by pointing to increased freight cost as they are now receiving coal by rail. The expense of production held is also continually increasing.

Coke

CONNELLSVILLE

Production of Conneltsville coke seems to be all going out on contract, and the market retains very little for purchasing purposes, so that there seems to be no immediate prospect of a broadening in the market, as far as there being any increase in supplies offered.

It is presumed that where buyer and seller were negotiating a contract and had not reached final terms, when the Government control came, they simply decided to consider that they had a contract between them with the Government price as the invoice figure, a regular contract to be negotiated upon the removal of the Government control.

The coke market is not active, but at least it is well defined, at the Government limits, \$6 for furnace and \$7 for foundry. Several weeks ago one or two coke operators were disposed to suggest to prospective buyers that some coke would be available if means were devised for making it net the seller more than the Government price, but all such efforts at evasion of Government regulations seem now to have disappeared.

There has been a division between operators in the matter of billing coke when the contract stands at above the Government limit, and there are still the two parties—comprising those who have made the concession to customers and those who have not. Making the concession simply means that the law has been lived up to.

The furnaces are being well supplied with coke, that is, much better than in previous months, and yet they could do with a good deal more. It requires a daily watching on the part of the furnaces to insure a sufficient supply. The cold snap at the beginning of the week, and another coming Thursday morning, made matters doubly hard for the railroads, and in consequence the car shortage has become aggravated, so that reports next week are expected to be very pessimistic as regards production of coke—two or three days this week no coal cars were furnished in the coke region at all, while cars for coke shipment dropped to 30 per cent.

BUFFALO

The situation is affected by the storm, some of the furnaces being very short of any supply. Such times occur so seldom that often not much effort it made to lay down much stock, on account of the extra cost. Furnaces are running as strong as conditions will permit.

Much improvement should be made next week. It is hoped that when the railroads return to private ownership after March 1 that a better distribution of cars will be made.

The ore season ought to open early, for the full amount under contract was not delivered last fall, but the hitch over rates is still on, with vessel owners standing for an advance. Coke prices are quoted on the basis of \$9.60 for 72-hr. Conneltsville foundry, \$8.60 for 48-hr. furnace and \$7 for off grades, per net ton f.o.b. here.